PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

(SECOND SERIES.)

VOL. IV.

WITH THIRTY PLATES.

(Plates I-XXIX and XIV *bis*.)

FOR THE YEAR 1889.

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(SECOND SERIES.)

PART I.

(Issued May 29th, 1889.)

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(Issued September 20th, 1889.)

Note.—In the explanation of fig. 7 of Pl. XVII. (p. 214), *for* "Side view of another example, showing relative convexity of the ventral valve," *read* Dorsal view of another example, showing fractured ventral umbo, and decorticated dorsal valve.

PART III.

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Note.—Figures 4-6, and 10-11 of Plate XIX refer to species to be treated of in a future paper.

PART IV.

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ERRATA.—VOL. IV.

(SECOND SERIES.)

Page 19, line 2—for *Willoughbeia* read *Willughbeia.*

Page 19, line 22—for *Sphærothalamus* read *Sphœrothalamus.*

Page 29, line 13—for *Malotus* read *Mallotus.*

Page 29, line 21—for *Adinandra* read *Adenandra.*

Page 29, line 29—for *Castania* read *Castanea.*

Page 33, line 28—for *Castania* read *Castanea.*

Page 45, line 6—*for* species *read* genus.

Page 55, lines 29, 32, and 35—for *Castania* read *Castanea.*

Page 56, lines 6, 7, and 15—for *Castania* read *Castanea.*

Page 58, line 22—for *Willoughbeia* read *Willughbeia.*

Page 86, line 2—for *Bœckia* read *Bœckea.*

Page 87, line 2—for *Soneratia* read *Sonneratia.*

Page 93, line 27—the final hyphen belongs to the line following.

Page 98, line 8—for *Rhodamnia trinervis* read *Rhodamnia trinervia.*

Page 107, line 24—for SPHÆROCARPA read SPHÆROCARPUM.

Page 107, line 25—for AZEDERACH read AZEDARACH.

Page 118, line 8—for *Fasciolaira* read *Fasciolaria.*

Page 204, line 17—*for* Genns PETERINEA *read* Genus PTERINEA.

Page 214.—In the explanation of fig. 7 of Pl. XVII. *for* "Side view of another example, showing relative convexity of the ventral valve," *read* Dorsal view of another example, showing fractured ventral umbo, and decorticated dorsal valve.

Page 367, last line—for *C. ewingii* read *H. ewingii.*

Page 415, line 7—for *pallida* read *pallidus.*

Page 422, line 5—for SUPERCILIOSUS read SUPERCILIOSA.

Page 451, line 30—for M. *striicollis* read *R. striicollis.*

Page 694, line 18—for *H. proxima* read *H. proximus.*

Page 724, line 14—for *R. flavipes* read *A. flavipes.*

Page 758, line 33—for *Goniomyia* read *Gonomyia.*

Page 818, line 10—for *P. tenuicornis* read *T. tenuicornis.*

Page 1029, line 6—for *Pöephila* read *Poëphila.*

PROCEEDINGS

OF THE

LINNEAN SOCIETY

OF

NEW SOUTH WALES.

WEDNESDAY, 30TH JANUARY, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair

The President announced that there would be no Excursion during February.

DONATIONS.

"Philosophical Transactions of the Royal Society of London." 65 vols. (1801-58 and 1881-87); "Transactions of the Royal Society of Edinburgh." 21 vols., with 6 Parts and 2 Appendices (1788-1881); "The Edinburgh Philosophical Journal." 90 vols. (1819-1864); "Nature." 13 vols. (1876-1882); "Zeitschrift für wissenschaftliche Zoologie." Bd. I.-XXXIX.; XLVI. Hefts 3 and 4; XLVII. Hefts 1 and 2 (1849-1888); "The Botanical Cabinet." By C. Loddiges and Sons. 21 vols. (1818-1833); "The Journal of Botany." 17 vols. (1863-1879); "Annales de la Société Entomologique de Belgique." Tomes I.-XXV. (1857-1882); "Tijdschrift

voor Entomologie." Vols I.-XXI. (1858-1878); "Entomologische Zeitung, herausgegeben von dem Entomologischen Vereine zu Stettin." Jahrg. I.-XLVIII. (1840-1887); "Mittheilungen aus der Zoologischen Station zu Neapel." Bd. I.-III. (1878-1882); "Archives de Biologie." Tome VIII. (1888); "Notes from the Leyden Museum." Vol. X., Parts 1-3 (1888); "Novæ Hollandiæ Plantarum Specimen." Auctore J. J. Labillardière. 2 vols.; "Roberti Brownii Prodromus Florae Novæ Hollandiæ et Insulæ Van-Diemen;" "Challenger Reports—Zoology." Vols. XXIII-XXV. and XXVII.; "Narrative." Vol. I., Part 1; "Ichtyologie, ou Histoire Naturelle des Poissons." Par M. E. Bloch. 6 vols. (1785-1788); "Fragmenta Phytographiæ Australiae, contulit Ferdinandus Mueller." Vols. I.-V. (1858-1866); "The Natural History of the Tineina." By H. T. Stainton, assisted by Prof. Zeller and J. W. Douglas. 13 vols. (1855-1873); "Reports of Explorations and Surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean, 1853-4." 12 vols. (1855-1860); "Proceedings of the Academy of Natural Sciences of Philadelphia." 28 vols. (1841-1876); "Proceedings of the Boston Society of Natural History." Vols. XIII-XX., Parts 1-3 (1869-1880); "Berliner Entomologische Zeitschrift—herausgegeben von dem Entomologischen Vereine in Berlin." Jahrg. I.-XXXII. (1857-1888); "The Geologist." Vols. I.-VII. (1858-1863); "The Geological Magazine, or Monthly Journal of Geology." 14 vols. (1864-1882); "The Natural History Review." 12 vols. (1854-1865); "Encyclopædia Britannica." 9th Edition. Vol. XXIV. (1888); "On the Anatomy of Vertebrates." By R. Owen, F.R.S. 3 vols.; "Elementary Text-book of Zoology." By Dr C. Claus, translated and edited by A. Sedgwick, M.A. 2 vols.; "A Text-book of Physiology." By M. Foster, M.D., &c. 5th Edition, Part I. (1888); "A Text-book of the Physiological Chemistry of the Animal

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"Half-yearly abstract of the Medical Sciences." 32 vols. (1857-1873); "Edinburgh Medical Journal." 4 vols. (1861 and 1862); "Comprehensive System of Materia Medica and Therapeutics." By Dr. Hempel; "Pharmacologia." By Dr. Paris; "Weale's Series of Scientific Manuals." 86 vols.; "Antiquities of Ireland." By Dr. Ledwich; "Narrative of an Expedition into South Africa, during the year 1836-1837." By Captain Harris; "A Dictionary of Practical Medicine." By Dr. Copland. (3 vols. in 4); "Lectures on Insanity for the Use of Students." By Sir A. Morison, M.D.; "Collection from the Unpublished Medical Writings of the late C. H. Parry, M.D.;" "Linnean Society's Journal—Zoology." 20 Parts; "Botany." 30 Parts; "Manual of New Zealand Mollusca." By F. W. Hutton; "The History of the Contagious Cholera," &c. By J. Kennedy; "Anatomy of the Human Body." Vol. III. (only). By J. and C. Bell, (6th Edition); "Popular Natural History." By Rev. J. G. Wood; "Indian Industries." By A. G. F. Eliot James; "The New Universal Magazine." Vols. II., III. and VI. (1788-1790); "Manual of Chemistry." By Dr. Fownes; "Synopsis of Fresh-Water Fishes of W. Trinidad." By T. Gill. No. I.; "Fisheries Act, 1881;" "An Act for the Amendment of the Fisheries Act of 1881," &c.; "A Catalogue of British Plants." (3rd Edition); "New Zealand Journal of Science." Vol. I., No. 1 (Feb. 1882); "Articles on the Propagation of Oysters." (Printed by order of the Commissioners of Fisheries); "The Australian Medical Gazette." Vols. I.-VII. (1881-1888), nearly complete; "British Medical Journal," 319 Nos. (1881-1888); "The Illustrated London News," 80 half-yearly vols. (1846-1886). *From Dr. James C. Cox, F.L.S., &c.*

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"Results of Meteorological Observations made in N.S.W. during 1886, under the direction of H. C. Russell, B.A., F.R.S.;" "Results of Rain, River, and Evaporation Observations made in N.S.W. during 1887." *From the Government Astronomer.*

"Travaux de la Section Médicale de la Société des Sciences Expérimentales, annexée à l'Université de Kharkow," 1886-87 et 1888. *From the Society.*

"The Transactions of the Entomological Society of London for the year 1888." Part III. *From the Society.*

"The Quarterly Journal of the Geological Society of London." Vol. XLIV., Part 4 (No. 176), 1888; "List of Members," &c., 1888." *From the Society.*

"Mémoires de la Société Royale des Sciences de Liége." 2e Série, Tome XV. (1888). *From the Society.*

"Horæ Societatis Entomologicæ Rossicae." T. XXII. (1888). *From the Society.*

"Zoologischer Anzeiger." XI. Jahrg., Nos. 293-295 (1888). *From the Editor.*

"Queensland Commission, Centennial International Exhibition, Melbourne, 1888.—The Mineral Wealth of Queensland." By Robert L. Jack, F.G.S., &c., Govt. Geologist. *From the Director Geological Survey of Queensland.*

"Catalogue of the Birds in the British Museum." Vol. XIV (1888); "Catalogue of the Fossil Reptilia and Amphibia in the British Museum (Nat. Hist.)." Part I. *From the Trustees.*

"Abstract of Proceedings of the Royal Society of Tasmania, 13th Nov., 1888." *From the Society.*

"Proceedings of the Zoological Society of London for the year 1888." Part III.; "Abstracts of Proceedings, 20th Nov. and 4th Dec., 1888." *From the Society.*

"Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft, Frankfurt a. M." XV. Band, 3 Heft (1888). *From the Society.*

"Archiv für Naturgeschichte." 52nd Jahrg., Band II., Heft 3 (1886): 54th Jahrg., Band I., Heft 1; Band II., Heft 2 (1888). *From the Editor.*

"Archives Néerlandaises des Sciences exactes et naturelles." Tome XXIII. Liv. 1 (1888). *De la part de la Société Hollandaise des Sciences à Harlem.*

"The Journal of the College of Science, Imperial University, Japan." Vol. II., Part 4 (1888). *From the President of the University.*

"The Proceedings of the Royal Society of Queensland, 1888." Vol. V., Part 4. *From the Society.*

"Technological Museum of New South Wales—The Useful Native Plants of Australia (including Tasmania)." By J. H. Maiden, F.L.S., &c., Curator. *From the Committee of Management.*

"The Pharmaceutical Journal of New South Wales." n.s. Vol. II., Part 1 (January, 1889). *From the Editor.*

"The American Naturalist." Vol. XXII., No. 262 (Oct., 1888). *From the Editors.*

"Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A." Vol. XVII., No. 2 (1888). *From the Curator.*

"Proceedings of the United States National Museum." Vols. X. (1887) [Sheets 46-49]; XI. (1888), [Sheets 1-8]. *From the Museum.*

"The Canadian Record of Science." Vol. III., No. 4 (1888). *From the Natural History Society of Montreal.*

"Tromso Museums Aarshefter." Vol. XI. (1888); "Aarsberetning for 1887." *From the Museum.*

"The Victorian Naturalist." Vol. V., No. 9 (January, 1889). *From the Field Naturalists' Club of Victoria.*

"Geological Survey of India.—A Bibliography of Indian Geology." Compiled by R. D. Oldham, A.R.S.M., F.G.S. (Preliminary Issue.) *From the Director.*

"Jaarboek van de Koninklijke Akademie van Wetenschappen, Amsterdam, voor 1886, 1887;" "Verslagen en Mededeelingen." Derde Reeks, Deel III., IV. (1887 and 1888). *From the Academy.*

"The Royal Society of Edinburgh.—Transactions." Vols. XXVII.; XXVIII.; XXIX.; XXX. (Part 1), (1872-1881); "Proceedings." Sessions 1878-1879 (Nos. 103 and 104); 1879-1880 (105-107); 1880-1881 (108-109). *From the Society.*

"Proceedings of the Royal Society of London." Vols. XLIII. (Nos. 262-265); XLIV. (Nos. 266-270) (1888). *From the Society.*

"Transactions and Proceedings of the Royal Geographical Society of Australasia, New South Wales Branch." Vols. III. and IV. (1885-1886) in one. *From Professor W. J. Stephens, M.A., F.G.S.*

"Feuille des Jeunes Naturalistes — Catalogue de la Bibliothèque." Fasc. No. 4 (1888). *From the Editor.*

"The Gold-Fields of Victoria.—Reports of the Mining Registrars for the quarter ended 30th September, 1888." *From the Secretary for Mines, Melbourne.*

"Prodromus of the Zoology of Victoria." Decade XVII. By Frederick McCoy, C.M.G., M.A., &c. *From the Premier of Victoria, through the Librarian, Public Library, Melbourne.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 37 (January, 1889). *From the Editor.*

"Oology of Australian Birds—Supplement, Part v." By A. J. Campbell. *From the Author.*

"Bulletin de la Société Impériale des Naturalistes de Moscou." Année 1888, No. 3. *From the Society.*

"Journal of the Royal Microscopical Society, 1888." Part 6 (December). *From the Society.*

ON THE VEGETATION OF MALAYSIA.

BY THE REV. J. E. TENISON-WOODS, F.L.S., F.G.S.,

HON. MEMBER ROYAL ASIATIC SOCIETY (STRAITS BRANCH).

(Plates I.-IX.)

The following essay being meant for the European residents of the Straits Settlements, technicalities are avoided, and explanations given which would not be necessary if it were addressed to a strictly scientific class of readers. In the absence of any published description of the flora, the figures given must be understood to be approximate only. The whole review of the vegetation is founded on my own observations aided by collections made in company with the Rev. B. Scortechini, or during my own subsequent travels.

Though the essay is said to be confined to the flora of Malaysia and deals principally with what may be considered the very heart of the region, it must be borne in mind that some portions of it are little known. Yet in a general way the floras of the countries around are well-known. Thus we are fairly well acquainted with the flora of Burmah as well as that of Siam, Cochin China, Cambodia or Tonquin. The Australian region to the south is as well known as any in the world. New Guinea has recently disclosed some of the secrets of its vegetation; therefore a general review of the flora of Malaysia ought to be easy to make without much risk of error.

GEOGRAPHICAL LIMITS.—Of the Malay Peninsula no more is here included than the portion south of lat. 5° 30′ N. This is its broadest part and includes many varieties of soil and climate. A few preliminary words are necessary as to—(1) The Physical Geography; (2) Geology; (3) Climate of this region.

The Malay Peninsula is covered with ranges of mountains running parallel with the general trend of the land. There are two systems of mountains; one running through the centre and forming a watershed between the east and west coasts; the other a broken series of ranges lying between the main range and the sea. The first mountain chain is the highest. It increases in extent and height towards the wider parts of the land, and many of its summits reach elevations of from 8,000 to 10,000 feet. It gradually declines from the interior of Perak, and after passing through the state of Malacca it subsides to the level of the sea in the island of Singapore.

The second range parallel with this consists of two or three parallel ranges. They do not form a watershed. There are several gaps and intervals between them through which rivers pass. These ranges rise to a height of between 5,000 and 6,000 feet. Some of them border almost on the very edge of the sea.

The geology of this region is very simple. The basis of the whole is granitic. This is overlaid in places by schists and slates, which, on the coast, where exposed to marine action, have decomposed into a reddish deposit called Laterite. The schists and slates contain large quantities of iron, forming purple, red, and brightly variegated strata. The Laterite, therefore, is a hydrated per-oxide of iron with clay, or Limonite. At the junction of the granite with the schists or Laterite, tin occurs, forming some of the richest mines of stream tin in the world. The main range is probably in its highest portions largely composed of schists. There are besides this a number of isolated outliers of crystalline limestone retaining traces of stratification. These form abrupt and precipitous mountain masses of limited extent, from 1,500 to 2,000 feet high. They do not contain fossils; but in Borneo similar masses contain Devonian fossils, and therefore it is probable that this is the age of the strata in the Malay Peninsula. There is scarcely any development of volcanic rocks on the western side, though I have seen a recent basaltic dyke in one place. But on the eastern side, half-way between the mountain range and the

sea, there are some andesitic ranges very similar to the Andesite rocks of the Philippine Islands.

Along the sides of the rivers are alluvial plains of limited extent but considerable depth. They consist of strata of alluvium from the neighbouring mountains, enclosing large stems, branches, and roots of trees of existing species.

The climate of the region is one of the warmest and most moist of the tropics. There are many countries even outside the tropics where the temperature has a higher range, but the peculiarity of this is that the mean temperature is perhaps a little above 85,° and that there are no seasons, no winter and no summer, or any period distinctly marked with periodical rains. Storms and disturbances of the atmosphere are almost confined to daily thunderstorms, sometimes of great violence, while gales of wind are of rare occurrence. The air is cloudy and misty, which moderates the excessive heat. The alternate north-east and south-west monsoons are felt, but scarcely more than felt. The average number of rainy days is said to be about half the year, while the mean rainfall is about 100 inches. The west coast, if subject to any remarkable change, is so from the visitations of certain squalls called Sumatras (as they are supposed to come across the Straits of Malacca from that island), but they are of short duration though violent.

The rivers run north and south, parallel with the main range, and eventually turn to the coast, and those which run a short course flow east and west of the watershed. Of the former there is on the west side the Perak River with its large tributaries the Plus, Kinta, and Batang-Padang. On the eastern side of the range there is an almost similar course taken by the Pahang and its tributaries. Both these rivers are supposed to drain an immense area, which is variously computed at between 4000 and 6000 square miles, but about which no accurate measurements can be given. The other chief streams on the west coast are the Bernam, Selangor, Langat, Klang, Linggi, Moar, and the Johore, the estuary of which faces Singapore. Between the Pakshan

(the lower course of which separates the Peninsula from Tenasserim in British Burmah) and the rivers Muda and Krian there are none but small streams. On the east side there is the Endau, the Pahang with its large tributaries, the Kuantan, the Besute, the Kelantan, and the Patani. The short rivers which flow east and west of the dividing range have their channels through marshy grounds, and their estuaries amid low mangrove islands. This is a feature which affects the vegetation of the region. Mangrove flats are well-marked areas in the vegetable kingdom. They fringe almost all the west coast of the Peninsula and a good deal of the east. They represent long periods of erosion on the mountain ranges. The heavy rains have, for ages, been washing away piecemeal the mountain axes of the country. These have been gradually lowered, and the land extended in the form of shallow mud flats of alluvium of considerable depth. The marshy soil has thus encroached on the Straits of Malacca and rendered them very shallow. Thus a fringe of low-lying, flat mud islands lines the shores of Sumatra on one side, and the west coast of the Peninsula on the other. These regions have been described as unattractive, dreary places of the most unwholesome kind; but this is erroneous. The soils are perhaps the richest in the world. They are densely clothed with vegetation. When the tide is out they do not look attractive, but the islands have a rich and picturesque beauty of their own. The beautiful masses of dark green and lustrous leaves form groves of ever-changing aspect, while probably the great evils of malaria are mitigated by the absorbing power of these trees. When the tide is in, the beautiful masses of foliage contribute most admirably to adorn the water scenery.

References will be made to some of the larger islands of the Archipelago. To treat of them separately would exceed the limits of this paper. Most of them are only partially explored, that is, botanically explored, and others have but little individuality. This region is the one above all which seems to offer the greatest results to botanical research. Take for instance Borneo, a country larger than England, Scotland, and Wales combined,

how much remains to be discovered amongst the solitary fastnesses of its interior forests.

CHARACTERS OF THE FLORA.—The portion of the vegetable kingdom of which this essay treats is the tropical Asiatic flora, but not all of it; and, moreover, including certain outlying plants. The limitations will be understood from the following:—Amongst the included plants of the Malayan Peninsula and the Archipelago many will be found generally distributed over India, excepting the dry parched regions of western India. Many extend eastward to Chittagong and eastern Bengal, several to Ceylon, and a few to tropical Africa; but none to central India. To the eastward many range over the South Pacific islands to North Australia; a few are found to the northward on the Chinese coast, probably extending over Cochin China. On the north-eastern edges of the region occur plants of the Chinese flora reaching it through the Philippine Islands. There is a small and peculiar Asiatic element in the vegetation which extends northward to Shanghai and Japan. Besides these, there are plants of course of world-wide distribution which have been introduced in many cases from remote countries, and now are spread everywhere. A characteristic instance of this in a common and rather showy weed named *Turnera*, of the order TURNERACEÆ, is met on the roadsides near Singapore, Penang, and Malacca, besides the other native states. The genus is almost entirely American, one only out of 70 species being found at the Cape.

The connection of the flora with that of the Philippine Islands is most intimate, as nearly all the genera are represented in that group. The exclusively Philippine genera are very few and nearly always confined to one species, such as *Diplodiscus*, *Dasycoleum*, *Carionia*, &c. The relations of the region to Australia are less extensive; but still the species common to both regions would make a list too long to be inserted here. They are chiefly tenants of the sea-coast, or common tropical weeds.

The best way to deal with the character of the flora as proposed in this essay will be first to describe generally its features, and then such subdivisions as arise from position, soil, climate, &c.

Numerically the Malayan flora is very rich in genera and species. Accurate figures cannot be given, but we may say that of dicotyledons there are about 1,000 genera and 3,000 species. Of monocotyledons 250 genera and say 1,000 species. This is a large proportion, the average being usually about one-fourth in tropical insular vegetation unless over very limited areas. But this estimate is founded on the opinion of more than one collector and botanist, and is borne out by the closely allied flora of the Philippines. The GYMNOSPERMEÆ are poorly represented.

Having no accurate figures to go upon, I must depend in some measure upon the estimates that have been made of some of the neighbouring floras such as the Philippines, and particular islands as Java, Sumatra, Borneo, Celebes, &c. In the Philippines the proportion of vascular cryptogams to phænogamic vegetation is nearly one-eighth, chiefly ferns.* Of these 52 species were not known from elsewhere at the time Mr. Rolfe wrote, or a proportion of one-tenth of the ferns indigenous to the Philippines. Since that time, however, the publication of Beddome's list of Scortechini's ferns,† and Hose's papers on collections of ferns made in West Borneo‡ has somewhat changed the numbers.

There is one peculiarity about the Malayan flora which must strike every observer, and that is the comparative absence of one

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* See Rolfe "On the Flora of the Philippine Islands." Jour. Linn. Soc. Botany, XXI. (1886), p. 283.

† "Jour. of Botany."' Nov. 1887, XXV. p. 321, pl. 278.

‡ "Jour. Linn. Soc. Botany, XX. p. 222; XXIV. p. 256; also "Jour. of Botany, XXVI. p. 323. See also Cesati's Memoir in Vol. VII. of the "Atti dell' Accademia, delle Scienze Fisiche e Matematiche di Napoli;" J. G. Baker, "Jour. of Botany," VIII. p. 37 (1870); and Burck's paper in Vol. IV. of the "Annals of the Botanic Gardens of Buitenzorg," p. 88 (1884).

of the largest, the most distinct, most uniform, and therefore the most natural of all the flowering plants, namely, the COMPOSITÆ. The Malayan region is certainly influenced in some way so as to almost exclude the order from its vast forest-clad plains and hills. It is at once the poorest in COMPOSITÆ, and those genera which are seen are destitute of any interest or peculiarity. There is not a single endemic genus, and every one of the representatives of the order in Malaysia spreads more or less over the Indian continent. A large proportion are little more than weeds which spring up rapidly and thickly where a forest has been cleared, and cultivated ground abandoned. Amongst these are *Ageratum conyzoides, Elephantopus scaber, Spilanthes grandiflora, Crepis japonica, Blumea hieracifolia* (very common), and *Vernonia cinerea.* These are ubiquitous weeds; they have taken thorough possession of the waste places in Malaysia. Bentham, in his essay on the COMPOSITÆ, says that if the known COMPOSITÆ of the Indian Archipelago were reduced to our ordinary standard they would not probably extend beyond 110 or 120 species. Beccari's collection of Sarawak plants made in Borneo in 1849 contained only six COMPOSITÆ.

The principal genera of a higher grade of COMPOSITÆ prevalent in tropical Asia are *Vernonia, Blumea* and allies, *Conyza* and allies, *Grangea* and allies, Gnaphalioid Inuloideæ, and Senecionideæ. No others can count ten species; the most remarkable among them being a few Mutisiaceæ (*Leucomeris, Dichoma, Ainsliæa, Catamixis, Gerbera*), mostly allied to South African species. *Ainsliæa* is a special type, the only genus of thistles which is chiefly tropical. But the Mutisiaceæ are thistles of a peculiar kind. There are three large tribes of COMPOSITÆ not found at all in the flora of Malaysia, though largely represented in America and South Africa. These are the Helenioideæ (*Gaillardia, Tagetes*), Calendulaceæ (Marigolds) and Arctotideæ. Yet there are some introduced weeds of this order.*

*See Bentham, "On the Classification, History and Geographical Distribution of Compositæ." Jour. Linn. Soc. Botany, XIII. (1873) p. 547.

DICOTYLEDONS.

Amongst these certain genera occupy a leading position and give a character to the whole flora. These are shown in the following catalogue. The genera of sedges and some of the insignificant weeds, rushes, grasses, &c., are not included in the estimate.

LEGUMINOSÆ :—Large genera : *Desmodium*, *Crotalaria*, *Cassia Bauhinia*, *Indigofera*, *Flemingia*, *Dalbergia*, *Pterocarpus*, *Cæsalpinia*, *Derris*, *Pithecolobium*.

Endemic genera :* *Mecopus*, *Phylacium* (Arch.), *Abauria* (B.), *Amherstia* (Ten.), *Pahudia* (Arch.), *Sindora* (M.P.).

URTICACEÆ :—The genus *Ficus* is beyond all question the most thoroughly characteristic of the Malayan flora, numbering formerly between 400 and 500 species, but since Dr. King's revision reduced to 207. They are trees or shrubs with milky juice, alternate leaves with varied shape, the leaf-buds covered by deciduous leaf-scales. The fruits or figs are called receptacles, closed at the mouth by numerous scales in rows; the base narrow, with bracts, sessile or pedunculate, in pairs in the axils of the leaves or of the scars of fallen leaves. Dr. G. King,† whose observations have been made almost exclusively on Indo-Malayan and a few Chinese species, has arranged them in seven sections, of which, leaving out the technical detail, the following are the characters :—(1) *Palæomorphe:* small trees and erect or subscandent shrubs. (2) *Urostigma:* usually trees or powerful climbers; epiphytal at least in early life; leaves alternate, entire, coriaceous, rarely membranous; receptacles in the axils of the leaves or of the scars of fallen leaves, with three bracts at the

*The following letters after the genus represent the locality in which it is found :—M.P. Malay Peninsula, S. Sumatra, J. Java, B. Borneo, C. Celebes, Mol. Moluccas, Ten. Tenasserim, Arch. Malay Archipelago.

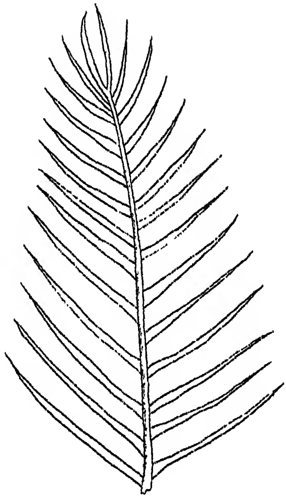
† "Observations on the genus Ficus with special reference to the Indo-Malayan and Chinese species," Jour. Linn. Soc. Botany, XXIV. (1887), p. 27.

Fig. 1 FRUIT OF DIPTEROCARPUS.

Baron & Gatward, lith

Fig. 2. DRYOBALANOPS AROMATICA.
Fig. 3. *Long sect of Fruit.*

Baron & Gatward, lith.



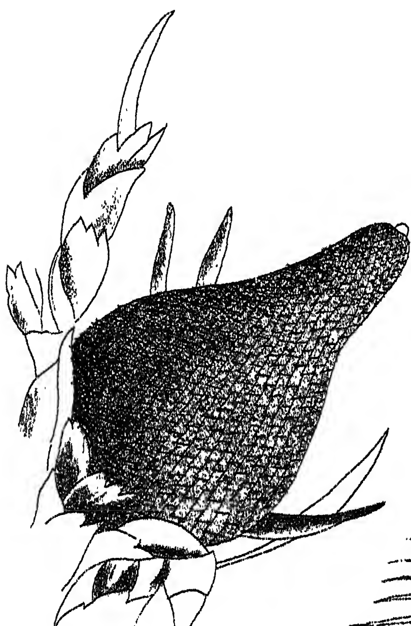


Fig. 23

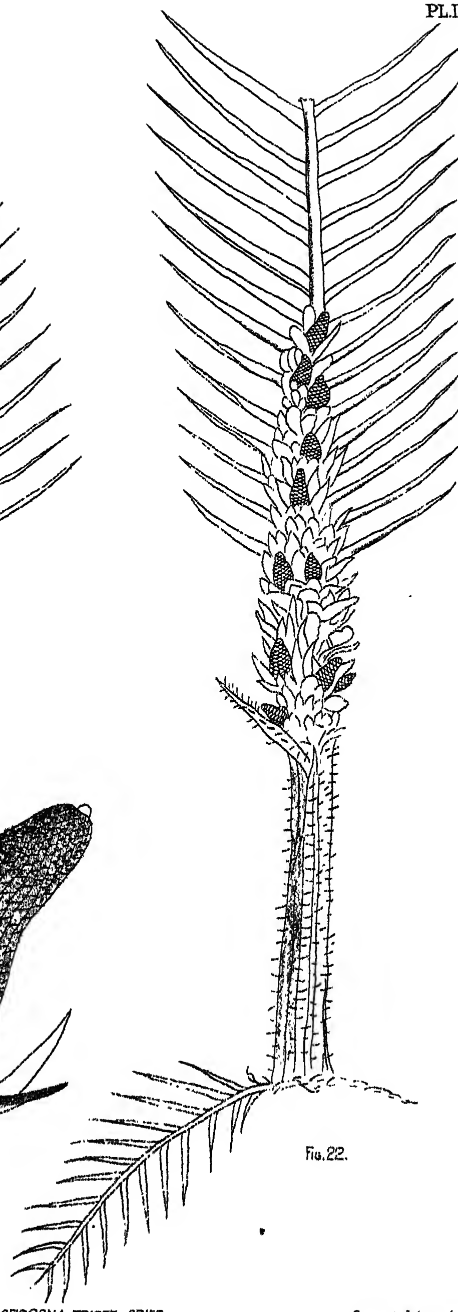


Fig. 22.

EUGEISSONA TRISTE, GRIFF.

Baron & Galward. lith.

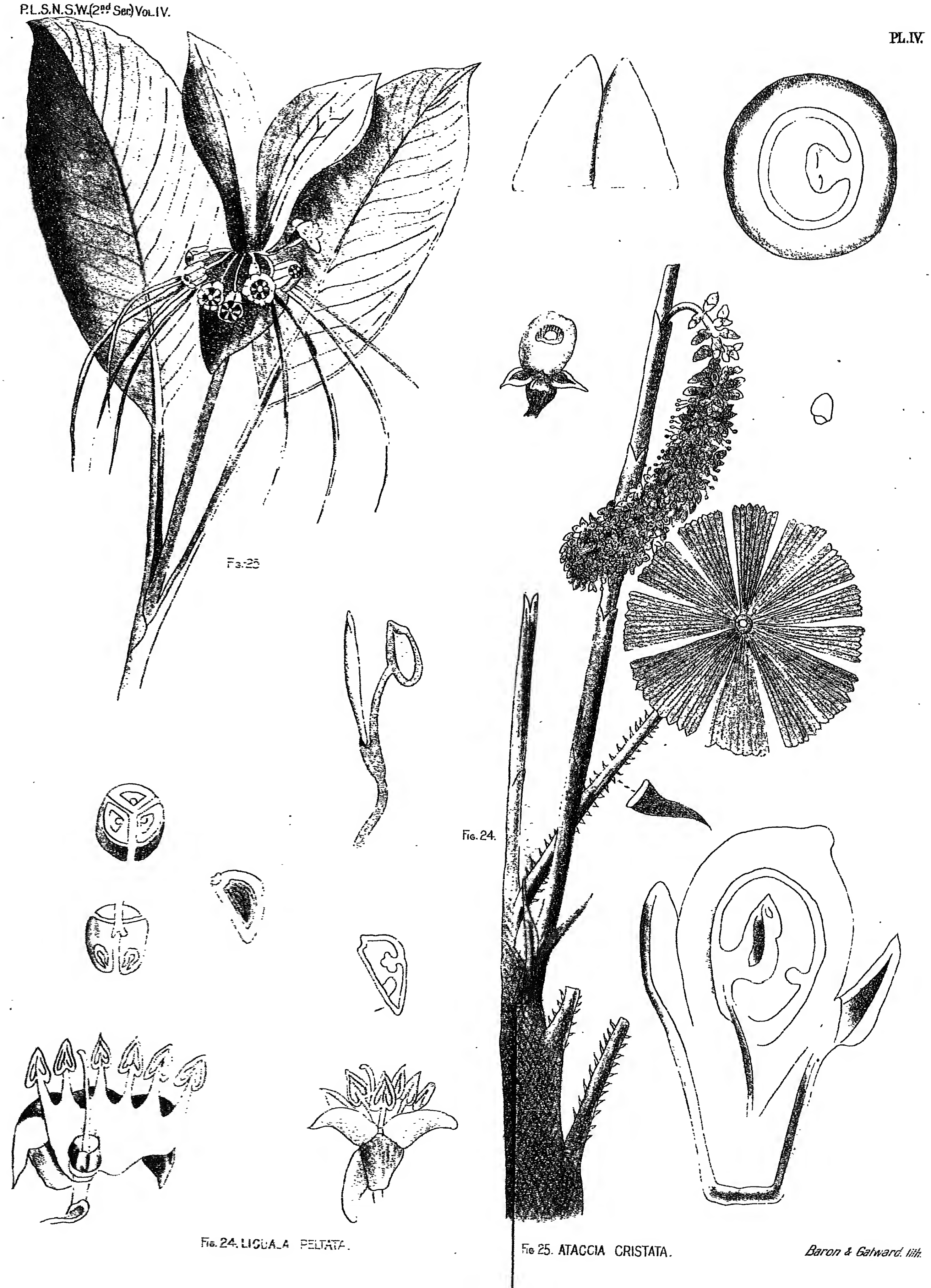


Fig. 24. LICUALA PELTATA.

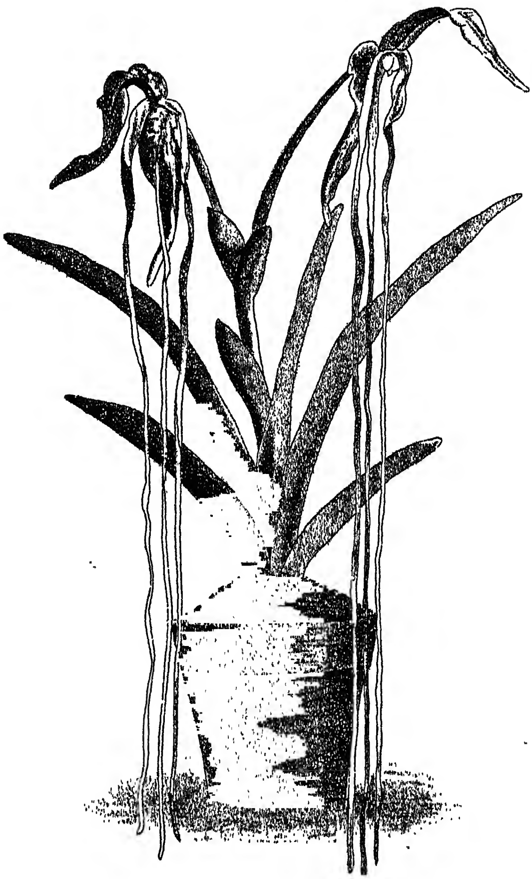
Fig. 25. ATACCIA CRISTATA.

Baron & Gatward lith.

J.E.T. Woods

Fig. 26. CYPRIPEDIUM SANDERIANUM.

Baron & Gatward. lith.



G.27. UROPEDIUM LINDENII. Baron & Gatward lith.

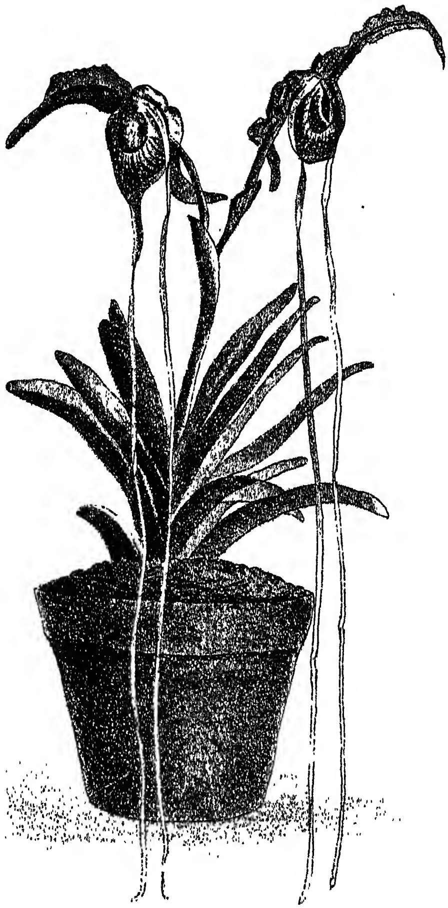


Fig 28. CYPRIPEDIUM CAUDATUM.

Baron & Gatward lith

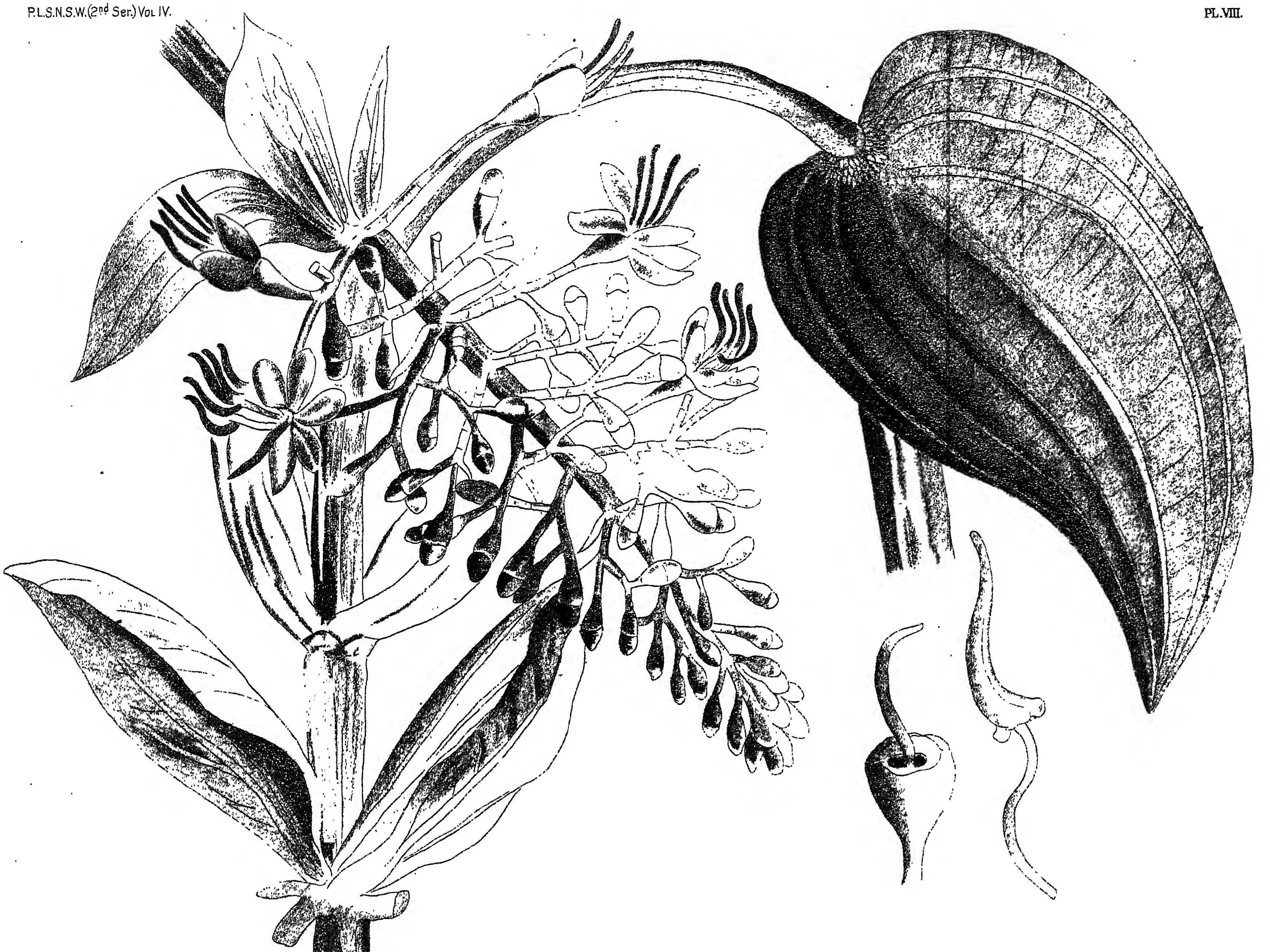
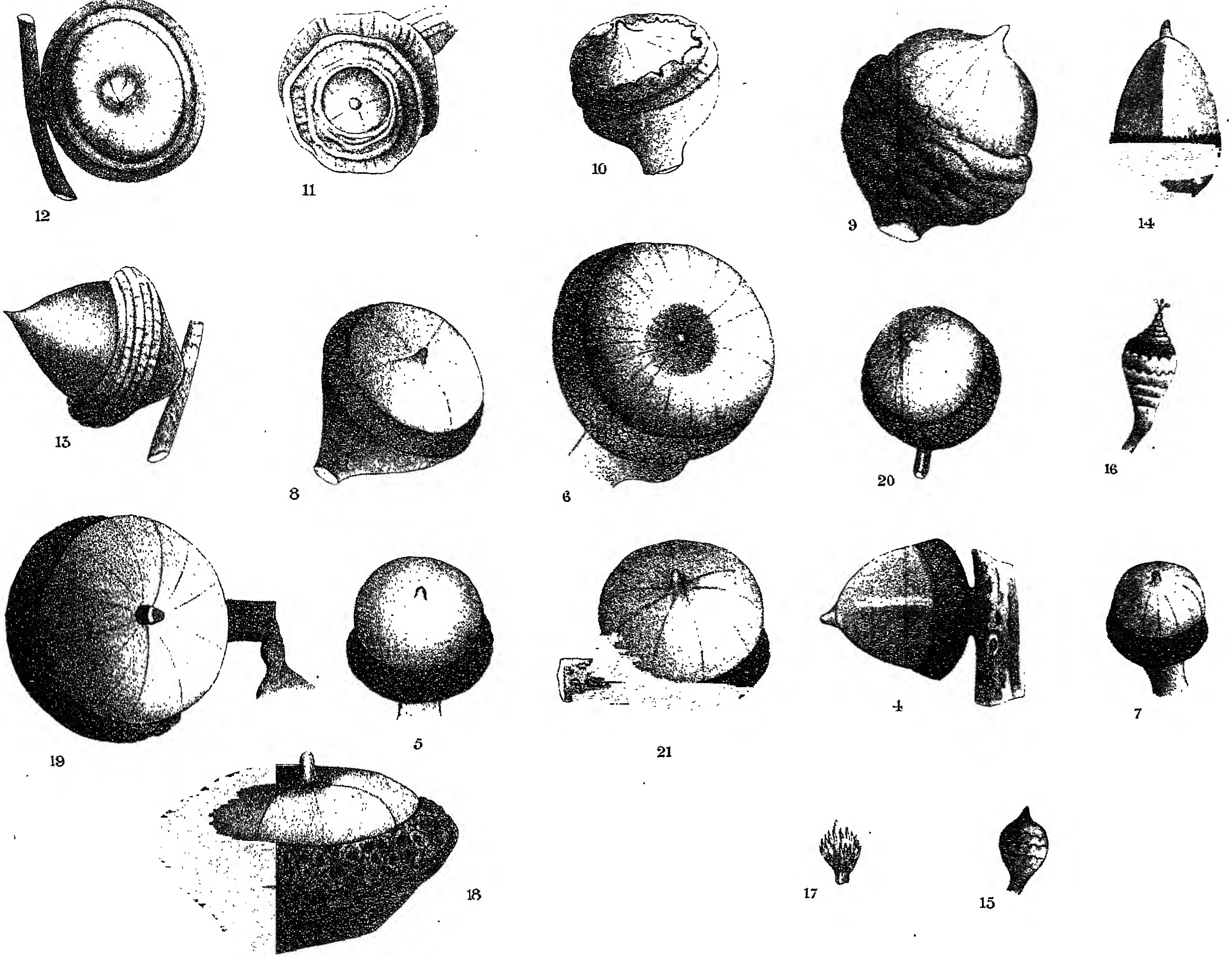


Fig. 29. MEDINILLA MAGNIFICA, Lindl.

Beron & Calward lith.



MALAYAN OAK FRUITS.

Bernard & Garrard lith.

base. This is the largest and most characteristic section. In no other is the tendency to be epiphytal at all strongly marked; in *Urostigma* it is universal. Many species in other sections are scandent and support themselves on trees and rocks by throwing out rootlets from their stems and branches. But these rootlets are furnished with fibrillæ and collecting-hairs like the roots that penetrate the soil, and are very different in appearance from the strong sub-divisions of the main axis by which the epiphyte embraces and ultimately strangles the tree to which it attaches itself. One constantly meets in the jungle fig-trees of this section, the stem of which is a perfect lattice of sub-divisions, the tree round which they were formed having entirely disappeared. (3) *Synœcia*: climbers with large coloured receptacles, the leaves tesselate beneath. (4) *Sycidium*: shrubs, small trees, or climbers; rarely epiphytal; leaves alternate; receptacles small, axillary and more or less scabrid. (5) *Covellia*: shrubs or trees; never epiphytes or climbers; receptacles on long sub-aphyllous branches issuing from near the base of the stem, often sub-hypogæal or on shortened tubercles from the stem and larger branches, or axillary. (6) *Eusyce*: scandent or erect shrubs or small trees; rarely epiphytal, leaves alternate, softly hairy, not scabrid or hispid; receptacles usually small, axillary. (7) *Neomorphe*: trees rarely scandent, never epiphytal: receptacles often very large, in fascicles from tubercles on the trunk and larger branches.

Ficus hispida, L., is one of the commonest species throughout tropical Asia and extends to North Australia and Hong Kong. It is also very variable, the variability being due in a great measure to the different situations in which it grows. This species bears the receptacles in pairs in the axils of the leaves, or in clusters on the trunk, and sometimes they appear in both positions on the same tree at the same time. The fruit from the trunk sometimes burrows in the ground. Other species have dimorphic receptacles, but this dimorphism bears no relation to the separation of the sexes.

Other large genera are *Celtis*, *Artocarpus*, *Pilea*, *Pouzolzia*.

Endemic: *Sloetia* (Arch.), *Parartocarpus* (B.).

RUBIACEÆ:—Large genera: *Hedyotis, Mussænda, Randia, Gardenia, Ixora, Morinda, Psychotria, Spermacoce.*

Endemic: *Creaghia* (M.P.), *Mussændopsis* (B.), *Lerchea* (Arch.), *Lucinæa* (Arch.), *Coptophyllum* (S.), *Trisciadia* (M.P.), *Aulacodiscus* (M.P.), *Lecananthus* (Arch.), *Gonyanera* (S.), *Praravinia* (B.), *Morindopsis* (M.P.), *Jackia* (M.P.), *Rennellia* (M.P. & S.), *Amaracarpus* (J.), *Gynochthodes* (Arch.), *Tetralopha* (B.), *Proscephalium* (J.), *Cleisocratera* (B.), *Mesoptera* (M.P.), *Litosanthes* (J.), *Myrmephytum* (C.)

EUPHORBIACEÆ:—Large genera: *Euphorbia, Phyllanthus, Antidesma, Croton, Acalypha, Mallotus, Macaranga, Excæcaria.*

Endemic: *Scortechinia* (M.P. & B.), *Chloriophyllum* (Arch.), *Paracroton* (J.), *Sumbavia* (Arch.), *Chloradenia* (J.), *Coccoceras* (M.P.), *Polydragma* (M.P.), *Cheilosa* (J.), *Cephalomappa* (B.), *Cladogynos* (C.), *Epiprinus* (M.P.), *Megistostigma* (M.P.).

MYRTACEÆ:—Large genera: *Bæckea, Eugenia, Barringtonia.*

MELASTOMACEÆ:—Large genera: *Osbeckia, Melastoma, Sonerila, Dissochæta, Medinilla, Astronia, Kibessia, Memecylon.*

Endemic: *Oxyspora* (S.), *Driessenia* (B.), *Ochthocharis* (M.P. and S.), *Anerincleistus* (M.P. & S.), *Phyllagathis* (Arch.), *Dalenia* (B.), *Creochiton* (J.), *Omphalopus* (J. & S.), *Pachycentria* (Arch.), *Pogonanthera* (Arch.), *Plethiandra* (B.).

LAURINEÆ:—*Cinnamomum, Actinodaphne, Litsea.*

Endemic: *Dehaasia* (Arch.), *Eusideroxylon* (B.), *Iteadaphne* (M.P.).

ACANTHACEÆ:—*Thunbergia, Eranthemum, Strobilanthes, Barleria, Asystasia, Justicia.*

Endemic: *Trichacanthus* (J.), *Filetia* (S.).

APOCYNACEÆ :—Large genera : *Willoughbeia*, *Alyxia*, *Alstonia*, *Tabernæmontana.*

Endemic : *Leuconotis* (Arch.), *Amblyocalyx* (B.), *Cerbera* (Arch.), *Dyera* (Arch.), *Micrechites* (Arch.), *Beaumontia* (Arch.).

ASCLEPIADEÆ :—Large genera : *Hoya*, *Dischidia*, *Ceropegia*, *Marsdenia*, *Stephanotis*, *Toxocarpus.*

Endemic : *Pycnorhachis* (M.P.), *Asterostemma* (J.), *Atherandra* (Arch.), *Myriopteron* (J.), *Conchophyllum* (Arch.), *Raphistemma* (Arch.), *Phyllanthera* (J.).

MALVACEÆ :—Large genera : *Sida*, *Abutilon*, *Hibiscus*, *Gossypium.*

Endemic : *Dialycarpa* (B.), *Durio* (Arch., 7 sp.), *Lahia* (B.), *Boschia* (Arch.), *Neesia* (Arch.), *Coelostegia* (M.P.).

STERCULIACEÆ :—Large genera : *Sterculia*, *Helicteres*, *Melochia*, *Buettneria.*

VERBENACEÆ :—Large genera : *Lantana*, *Lippia*, *Callicarpa*, *Vitex*, *Premna*, *Clerodendron.*

Endemic : *Geunsia* (Arch.), *Tectona* (Arch.), *Peronema* (Arch.).

ANONACEÆ :—Large genera : *Uvaria*, *Polyalthia*, *Melodorum*, *Xylopia*, *Unona*, *Orophea.*

Endemic : *Tetrapetalum* (B.), *Sphærothalamus* (B.), *Marcuccia* (B.), *Enicosanthemum* (B.), *Ellipeia* (Arch.), *Drepananthus* (M.P.), *Monocarpia* (B.), *Disepalum* (B.), *Eburopetalum* (B.), *Anomianthus* (J.), *Marsypopetalum* (J.), *Mezzettia* (B.), *Kingstonia* (M.P.), *Lonchomera* (M.P.).

CONVOLVULACEÆ :—Large genera : *Erycibe*, *Argyreia*, *Lettsomia*, *Ipomœa* (very numerous), *Convolvulus*, *Evolvulus*, *Breweria*, *Cuscuta.*

MELIACEÆ :—Large genus : *Turræa.*

PIPERACEÆ :—Large genera : *Piper* (very numerous), *Peperomia.*

Endemic : *Zippelia* (J.).

SOLANACEÆ :—Large genera : *Solanum, Physalis, Capsicum, Lycium.*

SCROPHULARINEÆ :—Large genera : *Mimulus, Stemodia, Limnophila, Herpestis, Gratiola, Torenia, Vandellia, Striga.*

AMARANTACEÆ :—Large genera : *Celosia, Amarantus, Alternanthera.*

SAPINDACEÆ :—Large genera : *Allophyllus, Guioa, Arytera.*

Endemic : *Aphanococcus* (C)., *Schleichera* (Arch.), *Nephelium* (Arch.), *Pseudonephelium* (B.).

BEGONIACEÆ :—*Begonia.* A large number of species are found on the mountain summits of the Malay Peninsula, and generally throughout the Indian Archipelago.

TILIACEÆ :—Large genera : *Grewia, Corchorus, Elæocarpus, Triumfetta.*

Endemic : *Pentace* (M.P. & J.), *Chartacalyx* (M.P.), *Schoutenea* (Arch.), *Phœnicospermum* (J.).

SAPOTACEÆ : — Large genera : *Chrysophyllum, Sideroxylon, Mimusops, Palaquium, Bassia, Payena.*

Endemic : *Diploknema* (B.).

OLEACEÆ :—Large genera : *Jasminum, Linociera.*

CUCURBITACEÆ :—Large genera : *Trichosanthes, Momordica, Cucumis, Melothria.*

ANACARDIACEÆ : — Large genera : *Buchanania, Mangifera, Swintonia, Rhus, Semecarpus.*

Endemic : *Pentaspadon* (Arch.), *Microstemon* (M.P.).

BORAGINEÆ :—Large genera: *Cordia, Ehretia, Rhabdia, Tournefortia, Heliotropium, Cynoglossum.*

AMPELIDACEÆ :—Large genera: *Ampelocissus, Vitis, Cissus, Leea.*

TERNSTRŒMIACEÆ :—Large genera: *Dupinia, Saurauja, Gordonia.*

ARALIACEÆ :—Large genera: *Aralia, Panax, Heptapleurum, Gilibertia.*

Endemic: *Hederopsis* (M.P.).

GUTTIFERÆ :—Large genera: *Garcinia, Calophyllum.*

CAPPARIDEÆ :—Large genera: *Cleome, Mærua, Capparis.*

EBENACEÆ :—Large genera: *Maba, Diospyros.*

LYTHRARIEÆ :—Large genera: *Rotala, Lagerstrœmia.*

COMBRETACEÆ :—Large genus: *Terminalia.*

LOGANIACEÆ :—Large genera: *Mitrasacme, Geniostoma, Buddleia, Fagræa.*

Endemic: *Norrisia* (M.P.).

RHAMNEÆ :—*Zizyphus.*

MENISPERMACEÆ :—No large genera; but the order is well represented.

GESNERACEÆ :—Large genera: *Æschynanthus, Didymocarpus, Chirita, Cyrtandra.*

Endemic: *Loxonia* (S. & J.), *Hexatheca* (B.).

POLYGONACEÆ :—Large genus: *Polygonum.* The Buck-wheat (*Fagopyrum*) is in cultivation.

DILLENIACEÆ :—Large genera: *Tetracera, Wormia.*

MAGNOLIACEÆ :—Large genus : *Michelia.*

BIXINEÆ :—Large genera : *Cochlospermum, Xylosma.*

Endemic : *Bennettia* (J.), *Pangium* (J.), *Bergsmia* (J.), *Taraktogenos* (J.).

NEPENTHACEÆ :—*Nepenthes.*

There are a few representatives also of the following orders :— HYPERICINEÆ, SIMARUBACEÆ, RHIZOPHORACEÆ, ERICACEÆ, LENTIBULAREÆ, THYMELEACEÆ.

MONOCOTYLEDONS.

Only a few Monocotyledons are here mentioned, either because they are specially dealt with under the headings of palms, orchids, &c., or because they would convey no idea of the flora. The grasses and sedges are wholly omitted, for there is little or nothing peculiar about them.

ZINGIBERACEÆ :—Large genera : *Globba, Hedychium, Curcuma, Amomum, Zingiber, Costus, Alpinia, Phrynium.*

Endemic : *Burbidgea* (B.), *Strobidia* (S.), *Riedelia* (Arch.).

AROIDEÆ :—Large genera : *Pothos, Rhaphidophora, Alocasia.*

Endemic : *Amydrium* (B. & S.), *Cuscuaria* (J.), *Podolasia* (B.), *Piptospatha* (B.), *Gamogyne* (B.), *Bucephalandra* (B.), *Aglaodorum* (S. & B.).

COMMELINACEÆ :—Large genera : *Commelina, Aneilema, Cyanotis.*

LILIACEÆ :—Large genera : *Smilax, Asparagus, Aloe, Dracæna Chlorophytum.*

PANDANEÆ :—Large genera : *Pandanus, Freycinetia.*

DIOSCOREACEÆ :—Large genus : *Dioscorea.*

AMARYLLIDEÆ :—Large genera : *Hypoxis, Crinum.*

For convenience the sub-divisions of the region will be taken in the following order :—

(1) The marine littoral region.

(2) The alluvial plains.

(3) Lower mountain slopes.

(4) Sub-alpine region.

Most of these regions are capable of further subdivision; though the divisions seems simple, it is not always easy to separate them. There are regions of an intermediate character where it is hard to decide to what they strictly belong. Furthermore, though the whole country is clothed with forest, this is particularly true of the mountain regions. In the alluvial plains there are extensive areas of open plains with no timber except of a low bushy kind. The plains are clothed with coarse grasses and are composed of poor soil. Most of these plains are subject to inundation, and indicate the extent of the overflow by their limits. Lands liable to inundation are not always densely clothed with forest, for the contrary is the case in some instances. There are wide savannahs of coarse grasses without much timber in the Malay Peninsula, as well as open forests with little timber and a dense undergrowth of jungle. The latter term is made to mean many things. Any thick entangled tract of uncultivated trees and shrubs, is called jungle; but what is distinguished by that term in Java, and what is known by the same name in the Straits Settlements, are two very different things, as will appear hereafter.

Mangrove Forests.—What are called Mangroves are forests growing on shallow marine mud-flats inundated by every tide, and in fact living in sea-water more than out of it. Most of the species germinate from the fruit while it remains attached to the tree. The radical and club-shaped crowns of the root gradually lengthen until they reach the soft muddy soil where they strike root and form a close thicket down to the verge of the ocean; a thicket both above and below. Above, the branches and leaves

entirely intercept the rays of the sun; below, each tree is raised upon a stool of roots, which spreads around over considerable spaces. These roots are swollen, and succulent, arching from the stem to the mud with the convexity upwards, and gradually raising the main trunk high above the mud. Most of the trees belong to the order RHIZOPHORACEÆ, which numbers about 50 species distributed through 17 tropical genera. A few do not germinate on the tree, but drop the developed fruit, where immediately it takes root, and so helps to spread the forest. One of the genera *(Pellacalyx)* is peculiar to the Straits of Malacca, and two (*Plœsiantha* and *Combretocarpus*) are restricted to Borneo. The others in the Peninsula belong to the genera *Ceriops*, *Bruguiera*, *Carallia*, *Gynotroches* and *Anisophyllea*, the last with four styles, while all others except *Combretocarpus* have only one style. The commonest species probably belong to the genus *Bruguiera.*

Besides the RHIZOPHORACEÆ the Mangrove forests are made up of many other plants; amongst which, in the Malay Peninsula, are three species, if not more, of *Sonneratia*, a genus formerly included amongst the MYRTACEÆ, but now placed with the LYTHRARIEÆ. It lines the muddy estuaries of the Malay Peninsular, Borneo, and, as far as I know, all the islands of the Indian Archipelago. It goes by the name of the Willow, and forms fluviatile thickets some little distance into the interior beyond the Mangroves but where the water is still brackish. It is something like a willow, but distinguished by a depressed fruit, around which the sepals of the calyx stand out in rays, reminding one of popular representations of the sun. The fruits of *S. acida*, L.f., are eaten by the Malays. The wood is stigmatised as soft and useless by Kurz, but he and M'Clelland say that the strong, hard, close-grained wood of *S. apetala*, Buch., is useful.

Quite as abundant is *Ægiceras majus*, Gaertn., which forms dense hedges round the islands of the Indian Archipelago and grows far outside the tropics in Australia. It is a pretty plant, covered for the most part of the year with cymes of fragrant flowers. It belongs to the MYRSINEÆ or Ardisiads, an

order producing handsome shrubs with evergreen leaves and red berries, and which, strange to say, has its greatest development in New Zealand. *Ægiceras* differs from Ardisiads in this, that the fruit, when ripe, becomes a follicle. Another shrub with the habits of RHIZOPHORACEÆ, though not belonging to the order, is *Avicennia officinalis*, L., a Verbeniad which extends all round the Australian continent, as well as being common in Asia, Africa, and America. The coasts of South Australia, especially in St. Vincent's and Spencer's Gulf, are thickly furnished with this kind of vegetable protection, which, though neither so luxuriant, so dense, nor forming such shady groves as the true tropical Mangrove, is thick and shrubby, and has a special beauty of its own.

Amid the Mangroves will be noticed a small tree with conspicuous fruits like a large green apple, three or four inches in diameter. This is (*Xylocarpus granatum*, Koen.) *Carapa moluccensis*, Lam. It has four to six large irregularly-shaped, closely packed seeds inside, which are said to be pressed for oil. It is not cultivated for the purpose, and it grows too scantily in the Mangroves to afford much oil. It extends to tropical Asia, westward to east Africa, eastward to the Moluccas, and southward to tropical Australia.

The Mangroves further inland are inundated only during spring tides. These thickets form a well-known belt within the true Mangroves, where the ground begins to be less muddy and a little higher and drier. Certain species are also found where there are no Mangroves at all, and these may be called the sea-coast tidal-thickets. The species found are *Hibiscus tiliaceus*, L., having large yellow flowers with a deep crimson centre, besides other showy species; *Thespesia populnea*, Corr., famous for the rich yellow dye exuding from the brown seed-vessel; *Heritiera littoralis*, Dryander, or the Looking-glass Tree; *Excœcaria agallocha*, L., a tree with a milky juice which causes blindness, and so does also even the smoke from the wood when it is burned; *Antidesma bunius*, Spreng., a euphorbiaceous tree which extends over the

Indian Archipelago, the Philippines and South China, having large acid fruits, black or white when ripe; *Cerbera odallam*, Gaertn., a glossy evergreen tree with white flowers and oval or elliptical green fruits (black when ripe), said to be extremely poisonous, but the seed of which is pressed for lamp oil; *Erythrina ovalifolia*, Roxb., with large dull purple flowers and the trunk armed with sharp thorns; *Dalbergia pongamia*, *Derris*, and other climbing leguminous plants, including *Abrus precatorius*, L., whose scarlet and black seeds are known all over the world.

The above are the common and conspicuous trees and shrubs amongst the Mangroves on the whole of the Malayan sea-coast. There are also found along the banks of the estuarine streams on the west coasts of the Peninsula, *Nipa fruticans*, Wurmb., a Palm-tree which has not the advantage of a stem, but yet forms one of the most attractive and interesting members of the order. It lines the lower part of many of the coast streams to the exclusion of almost every other vegetation. It is difficult to describe the singular effect of long lines of feathery palm-leaves, twenty to thirty feet long, gathered in thick clusters on both sides of a river. The plant is one of the giants of vegetation, and it is as useful as it is big. The leaves are cut down and form all the houses in the Malay region. The pinnæ of the fronds are plaited in various forms to make walls, wainscots, and partitions. Throughout Malaysia the people have no other roof for their dwellings than these fronds laid over each other like tiles, giving a leafy covering more or less impervious to rain. It is good enough unless when the wind lifts it up, and then woe to the interior of the dwelling in a tropical storm. This is the well-known attap roof universal in the Peninsula.

Further up the banks the thicket is intermingled with a fern which is a giant of its kind (*Acrostichum aureum*, L.) with fronds eight and ten feet long, and a showy prickly Acanthaceous plant with blue and white flowers (*Acanthus ilicifolius*, L.), both of which are as common in Northern Queensland as they are in the Malay Peninsula. A Screw-pine (*Pandanus*) almost com-

pletes the census of this river-bank flora, for the *Nipa* absorbs everything. Such thickets does it make that whole islands are floated off by the spring tides, and these cruise about, especially off the coast of Borneo, like patches of marine jungle. I can testify to the strange appearance they present when met far from the land, sheltering sea and land birds together. The fruits on a short stalk amongst the stolons are quite as big as a man's head. They are cut off before maturity, and the juice which exudes is fermented, and forms an acid and not very agreeable stimulant.

Altogether the Mangroves are of the highest interest to botanists, and possess a beauty of their own. It is a wonderful provision of nature which associates together so many luxuriant trees of great beauty of foliage, growing so richly in salt water, a medium fatal to nearly every land plant.

Alluvial Plains.—The alluvial plains are thickly studded with clumps or belts of timber, and open grassy savannahs where the lofty Lalang or jungle-grass (*Imperata arundinacea*, Cyr.) meets above the head. This is interlaced by many climbers such as the climbing ferns *Lygodium scandens*, Sw., *L. japonica*, Sw., and *L. flexuosum*, Sw. At a distance such open spaces look like meadow-land of bright green with little clumps of trees like a park. But the ground underneath is sloppy, and the meadow is full of coarse vegetation and harsh grasses very difficult to walk through. It is a flowery region. About Singapore and through all the Straits Settlements *Thunbergia alata* with its yellow or white blossoms, and a very large-flowered blue species, *T. grandiflora*, are common in almost all the clumps of trees. *Callicarpa longifolia*, a tree with minute pink flowers in large clusters, is everywhere on the plains, with a tender spring-like look about it. Showy *Ixoras* also are common with a profusion of long-tubed scarlet, pink or white flowers. But most frequently met is *Melastoma malabathrica* with large pink salver-shaped flowers. It is like a dog-rose at a distance except for the few long stamens with a prolongation of the connective ending in two spurs. This species is as common at Hong Kong as in the Straits Settlements, and equally so

in Australia as far south at least as Moreton Bay. The structure is well worthy of attention. The stamens, ten in number, are dissimilar in size, shape and colour, five being large, violet, and having two long spurs, and five small and yellow with no projection. It may possibly be mistaken for *Rhodomyrtus tomentosa*, a shrub four or five feet high with large pink flowers, but they are axillary. The species is widely spread over Southern India, Penang, Malaysia and northwards to China and Japan, and the Philippines. The natural order of MELASTOMACEÆ is largely represented in the flora of Malaysia.

Besides the grassy plains in places the forest is rendered almost continuous by a better or drier soil. Around Singapore the flora is modified thus. The place of the grass is taken by large bushes of *Gleichenia dichotoma* and *G. flagellaris* which, with a few other ferns (*Blechnum orientale*, a species of *Lomaria*, *Polypodium*, *Vittaria*, &c., &c.), entirely occupy the ground. There is an undergrowth, however, in places of the *Melastoma* and *Rhodomyrtus*, *Cassia alata*, *C. sepiaria*, *C. tora*, *Solanum verbascifolium*, *S. ferox*, *S. sanctum*, and *Lantana camera*. There are few palms, but I have noticed occasionally that extremely handsome palm-tree *Cyrtostachys rendah*, though much more common in Labuan than it is at Singapore.

The alluvial plains are varied by occasional swamps which are always thickly covered with *Nelumbium speciosum*, L. This solitary species demands a passing notice. It lives with its rhizomes buried in the mud. Its large orbicular leaves on the upper surface, which, determined to breathe air, break up the water into crystal dew-drops; the large, deep rose-coloured flowers and the nuts or seeds nearly buried in a receptacle like the rose of a watering-pot, all make it a most interesting, as well as beautiful, ornament to still waters. The *Nelumbium* is indigenous in the waters of the Nile, and is found in the rivers of Persia and India; in Cashmere up to a height of 5,000 feet; in the Volga up to the 46th degree of north latitude; in China; in Japan; and then in tropical Australia. Probably some of this wide-spread area is

due to introduction. It divides the beauties of the still waters in Malaysia with *Nymphæa*, a large blue, yellow or red-flowered water-lily even bigger than *Nelumbium*, easily distinguished by the cluster of stamens in the middle Its leaves float in the water, and they are recognised by their very long stalks, which are much sought after in North Australia by the natives as an article of food. So is the root of the plant also, and even the Malays make use of it. All that might be said about this flower may be guessed in saying that it is the Lotus of the ancients.

Sometimes the open forest is dry and rocky with out-crops of Laterite. This supports a somewhat different flora such as *Malotus philippinensis* and *M. javanica*, *Cinnamomum spurium*, *Fagræa peregrina*, several species of *Eugenia*, *Ficus*, *Mæsa* (a large genus of MYRSINEÆ belonging to Africa, Asia, and Australia), *Phyllanthus emblica*, a feathery-leaved small tree with conspicuous green acid fruits, *Sindora siamensis* (?), a tree with one-seeded indehiscent spiny pods borne on long pedicels. There are several species of *Myristica* or wild Nutmeg, notably a long-leaved form with a thick brown tomentum (*M. sesquipedalia*). *Adinandra dumosa* is a common and handsome tree of the tea family.

RIVER VEGETATION.—This is the richest portion of the forest lands and supports a dense growth of trees. It would require a long list to describe this flora. On the banks of even the small creeks I have seen the finest trees, and the undergrowth is so dense that daylight scarcely penetrates. The common trees are *Ficus* (many), DIPTEROCARPEÆ including *Shorea*, *Hopea*, *Vatica*, *Artocarpus* (many), *Castania*, *Castanopsis*, and plentifully, *Rhodamnia trinervia*, *Cratoxylon polyanthum* (one of the St. John's Worts), *Evodia roxburghiana*, *Ixonanthes icosandra*, *Phyllanthus superbus*, *Elæocarpus* (several), *Canarium* (two or three), *Commersonia echinata*, *Vitex trifoliata*, *Macaranga tanarius*, *Pithecolobium* (several), *Maba ebenus*, *Diospyros fruticosus*, *Alstonia macrophylla*, *A. scholaris*. The last named is seen quite as frequently on the grassy plains where it lifts its head as a conspicuous straight stem,

divided into regular stages by whorls of large laurel-like leaves. Occasionally one meets *Antiaris* or the far-famed Upas-tree, formerly supposed to be confined to Java. The natives know it well, but do not seem to be much afraid of it, at least in the manner related by travellers of old. There is also a large fleshy fetid Aroid named *Amorphophallus* likewise used as a poison for arrows, or to intensify the venom of the Upas, here called Ipo.

This vegetation is laced together by numberless vines and creepers, such as *Entada scandens* with enormous pods, and beans large enough to be made into match-boxes; *Mucuna gigantea* with its crop of irritating hairs on the outside of the pod. *Bauhinias* abound as well as Melastomaceous creepers of the genera *Medinilla* and *Sonerila*. The true vines (*Vitis*) are represented by many species, as well as climbing genera of the natural orders MENISPERMACEÆ, APOCYNACEÆ, ASCLEPIADEÆ.

The Palms, as might naturally be expected, are numerous, including the destructive *Calamus* whose thorns few escape in the jungle. They are perennial spreading shrubs or small trees, lithe and supple, erect as well as climbing. The whole plant is densely clothed with formidable thorns. It is difficult to keep out of their way. The petiole is modified into a thong or prolongation, covered with hooked prehensile spines of cruel design. Woe to those who are caught in these tendrils. The struggle to free oneself from one brings down a dozen, each being as difficult to detach as a puzzle. *C. grandis* is common at Penang and in all the Straits of Malacca, with many species besides. *C. rotang*, *C. rudentum*, and several others are largely exported for chairs, baskets, mats, hats and other useful articles. The celebrated Malacca canes are derived from *C. scipionum*. It is not common, and the natives who gather, stain and sell it, do not care to make its habitat known. It does not grow anywhere near Malacca. *Zalacca edulis* is a tufted short-stemmed palm with leaves eighteen to twenty feet in length, growing abundantly in moist shady places. The pinnules about eighteen inches long and five broad, are at first ascending, then curved downwards, oblong-spathulate, lanceolate

and tapered into a long subulate bristle. They are 3-keeled above, the margins furnished at intervals with short bristles. Other Palms might be named, but they belong more to the mountains than to the alluvial plains.

Finally a few of the common trees may be mentioned. They are *Randia densifolia*, *Memecylon plebeium*, *Gironniera celtidifolia*, *Symplocos pedicellata*, *Rourea splendens*, and several species of *Elæocarpus* which the natives here call Jelei.

The undergrowth includes one or two remarkable plants. One is *Haloragis disticha*, a showy little shrub something like Box only that its leaves are pointed, while the branches spread out in distichous sprays of a neat and graceful form. No one would take it to be a *Haloragis*, though this is one of the non-aquatic genera in an order principally composed of water-plants. It is met occasionally on the mountain sides. *Leea sambucina*, a member of the vine family without tendrils, and a shrub, is conspicuous for the deep crimson colour of its younger leaves, whose stalks are dilated at the base so as to enclose the plant in a kind of sheath. It extends to the tropics of Australia, and perhaps is identical with a common African form. *Trema virgata* and *T. amboinense* are frequently seen, mingled occasionally with more than one species of *Uvaria*, having clusters of fruits like a bunch of yellow grapes on which the monkeys are said to feed. *Uvariæ* are climbing plants, beautiful looking with their golden fruits, and showing under the microscope most interesting stellate hairs. The LEGUMINOSÆ have many representatives, such as species of *Indigofera*, *Tephrosia candida*, *Crotalaria striata*, several species of *Cassia*, *Derris*, and *Albizzia*. The ornamental shrubs include *Ixora*, *Gardenia campanulata*, *Clerodendron velutinum* and other species, *Pavetta indica*, differing but little from the *Ixoras* except in having the corolla twisted in the bud, *Dracæna angustifolia*, *Dianella ensifolia*, several species of *Costus*, with the large and luxuriant *Alpinia nutans*. Amongst the useful plants may be mentioned one highly valued through the east as far as Japan. This is *Delima sarmentosa* (*Tetracera*), widely distributed in tropical Asia.

The upper surface of the leaves is covered with hard asperities, so rough that the leaves are used (like many kinds of Fig-trees) as a substitute for sand-paper.

The character of the river vegetation will be best understood from the following entry in my diary :—" Got the elephants loaded in good time and sent them away. Walked two miles on a good road to a village on the banks of the Kinta. Crossed the river on elephants, and then succeeded a tedious journey through swamps, the elephants being mostly up to their bellies in mud. After this we went through an open jungle supporting a thick weedy growth of *Lantana camera*, with a small *Eugenia* and *Melastoma malabathrica*, the fruits of both of which our Malays ate freely, though the berries were small and unpalatable. The country soon became thick forest, both boggy and broken under foot, on a track which none but an elephant could travel. Emerging from this we came upon a deserted plantation of which there are, alas, a good many in Malay countries. It was on a rising ground, covered with *Lantana* but intermingled with *Solanum pentadactylum*, rendered conspicuous by yellow fruits with protuberances something like fingers. This is a native of Trinidad about Saint Anne's and the port of Spain. It is a shrub two or three feet high, with an erect stem, and leaves sinuated, with acute segments shining above. It looks as if it had been cultivated, but the Malays do not eat the fruits and said they were poisonous. This is one of many instances in Malaysia, of small patches of an introduced plant flourishing as a weed, but very local; more common amongst the SOLANACEÆ than any other order.

"The view from this abandoned farm was across a wide plain to the eastward, bounded by an abrupt and broken range. The forest was open, and looked like moorland in Europe. When we got off the cultivated area we plunged into a dense growth of *Costus*, a shrub of ornamental character belonging to the ZINGIBERACEÆ. Thickets of this kind are common, 12 or 14 feet high. The only method of making one's way through them is by the aid of the jungle-knife or parong, which has to be slashed right and left with

much force. A journey of a quarter of a mile thoroughly exhausted our Malays, and we were not sorry to find ourselves once more upon the swampy ground of the river Raya and close to the village of that name."

LOWER MOUNTAIN SLOPES.—There is a decided difference between the forests on the lower slopes of the mountains and those on the summits and on the plains. The trees are more varied and finer. In fact, this is where the forests are seen in their grandeur, because on ridges or the summits of ranges the trees are often stunted and the timber poor. In the lower forests the undergrowth, amid dead and decaying timber, is nearly impenetrable. The surface of the ground becomes only occasionally visible, and the difficulty of travelling through such places is really great. In this region and that of the plains are the same genera, slightly varied in proportion, but with a more stately and luxuriant growth. *Dipterocarpus*, *Shorea*, *Hopea* and *Vatica* are numerous, with Fig-trees, Chestnuts, Oak-trees, and an occasional coniferous tree of the genus *Dammara*. It was always a subject of admiration to me to notice the varied tints of the vegetation on the mountain slopes. At a distance they wore a uniform hue of sombre green or purple; but when near it was surprising how the surface was dappled with colours like a garden bed. Trees that looked like bunches of pink, bluish-red or yellowish flowers, stood out in surprising numbers. This appearance was often due to blossoms; but also it was owing to the variegated leaves, and, sometimes though more rarely, to the fruits. Those common and conspicuous were *Cinnamomum spurium*, a *Castania* or *Castanopsis* (a genus which cannot be maintained), a sapindaceous tree named *Cupania fuscidula*; and trees of light green foliage, such as *Eriodendron* and *Albizzia*, help to vary the colour. There are also several species of *Artocarpus* and *Eugenia*, with wild *Garcinia* or Mangosteens, Ebonies, the real *Ebenus*, and *Diospyros fruticosus*, *Canarium*, *Guttas*, *Isonandra*, *Bassia* and *Dichopsis*, with the useful *Fagræa peregrina* and another *Fagræa* with large flowers, of which more presently. The Palm-trees belonging to this region

are *Arenga*, *Areca*, *Calamus*, *Eugeissona*, *Caryota*, *Corypha Licuala*, the Nibong which is an *Areca*, with *Slackia* and *Macro cladus* which the Malays call Ebul.

Sub-alpine Region.—In the higher mountain regions the tree vegetation becomes smaller and more scanty, and on the summits almost disappears. There is an alpine vegetation, differing altogether however from what is understood by that name in European countries. This flora is of an Australian character, a fact difficult to explain. It includes *Melaleuca*, *Leucopogon*, *Vatica*, *Rhododendron*, and *Nepenthes*, mingled with peculiar cryptogams and the conifer *Podocarpus*. A similar flora is seen on the mountains of Borneo, Java, Celebes, and some of the Philippine Islands.

Over about 3000 feet above sea-level the vegetation becomes thinner and smaller. Cryptogams take the place of dicotyledonous plants, and even these, where they are not peculiar, are less tropical. A species of *Pterocarpus*, several members of the Tea family (Ternstrœmiaceæ), some Pittosporeæ (*Bursaria* ?), a *Microtropis* and *Euonymus* (Celastrineæ), an *Ilex*, and a *Daphniphyllum* are amongst the remarkable plants, with Orchids, Begonias, Caladiums, Marantas, Lycopods, Selaginellas, Ferns, Mosses, Lichens, and Fungi innumerable.

Limestone Rocks.—The numerous outliers of limestone have a distinct flora, but not the same in every place. Certain species re-appear wherever the limestone crops out. Owing to the facility with which limestone strata are eroded, they are generally detached, precipitous and inaccessible mountains. A striking instance is Pondok in Perak, which is a gigantic rock at the eastern opening of the pass at Gapis, about 1500 feet above the level of the sea.* It is crystalline, and the stratification seems to be almost obliterated; but yet what does remain in this and other places has a considerable dip. I have never heard that

* In my report on the geology of Perak this, by a misprint, is stated to be only 300 feet high.

anyone was able to get to the summit; but it is full of fissures and cavities which are overgrown with a luxuriant and apparently peculiar vegetation, differing from that of the country around. At Selangore, at the limestone caves, I was able to make a good collection of plants, but they were mostly Lycopods and Ferns. Similar limestone cliffs are found in the Calamianes and Cuyos Groups, amongst both of which I collected plants, but not many, as the difficulty of getting on to the rocks was nearly as great here as at Gunong Pondok. Ferns and Lycopods were, as usual, the principal spoils, with, in the Philippines at least, a *Tristania.*

DIPTEROCARPEÆ.—This is a natural order of fine forest trees with conspicuous fragrant flowers, yielding good timber and valuable aromatic resins, balsams, and oils. It is an order which stands aloof, so that its limits can be concisely defined. Its peculiarities are the long wing-like lobes of the calyx, with nerves like the root-scales of a fern, and generally richly coloured from red to brown. The leaves have rolled-up stipules like the Magnolias, and they terminate the branches with a taper point; the foliage is like that of an oak tree, and as in oaks the cotyledons perform their office without rising above the ground. The cup of the acorn and similar organs in the filbert, chestnut, beech, &c., are represented in the hardened calyx of these trees, which have a tendency to sacrifice all the ovules but one. The order flourishes best in the Malayan region, and is confined to tropical eastern Asia. The species range on the west from Assam, through eastern Bengal to Ceylon. Eastward they extend through Burmah and Siam to Cambodia and the Philippines. Southward they are found in the Andaman Islands, the Malayan Peninsula, Borneo, Sumatra, and Banka; but only to a small extent is the family at present known east of Wallace's line through the Straits of Macassar.

The order was discovered in 1798; four species of *Dipterocarpus* were sent to Sir Joseph Banks by Dr. B. Hamilton from Sumatra. But the order was not defined until 1825 by Gaertner. At that time a dozen species were not known, and now there are upwards

of 200. It is divided into about a dozen genera, namely—(1) *Dryobalanops*, (2) *Dipterocarpus*, (3) *Ancistrocladus*, (4) *Anisoptera*, (5) *Pachynocarpus*, (6) *Vatica*, (7) *Shorea*, (8) *Hopea*, (9) *Doona*, (10) *Vateria*, (11) *Monoporandra*. Some botanists include the genus *Lophira*, which Endlicher erects into a separate order from its marked differences. It does not, however, belong to the Malayan region, but to west Africa.

Dipterocarpus—trees with two winged seeds—has given the name to the order. In reality there are five wings, but two of the lobes are much larger than the other three, which crown the calyx as small leaf-like sepals. *Dryobalanops* has the lobes of the calyx nearly equal, and they form five spreading wings round the fruit, something like a shuttle-cock. In *Ancistrocladus* the five lobes of the calyx are similar, but the genus is composed of climbing shrubs with claw-like thorns. In *Anisoptera* there are two large wings with inconspicuous stipules; its ovary and fruit partly inferior in reference to the insertion of the calyx, but having a concave receptacle, the edges of which bear the corolla and stamens. In *Vatica* there are five stamens opposite the petals, five alternate with them, then outside each of these a small stamen. *Vatica* is distinguished by its calyx, which is sub-valvate or with pieces not touching one another in the bud, and forming round the fruit five large free wings not adherent to the fruit but enveloping it closely. *Pachynocarpus* has the same flowers, a concave receptacle with a calyx which disappears round the fruit. *Vateria* has the free ovary of *Vatica*, but a small calyx reflexed under the pericarp. *Monoporandra* has the fruit of *Vateria*, but only five stamens. *Hopea* has the flower of *Vateria*, and two only of the five non-adherent sepals dilated in wings round the fruit. *Shorea* can hardly be separated from *Hopea*; but if distinguished at all, it is by the *three* large wings developed from the calyx lobes. *Doona* has three wings also, enclosing an embryo with cotyledons full of much-contorted folds, and the flowers are red.

All the species of this order are filled with resins, balsams, or oils, which render them valuable. The Oil-tree of the Malays is

derived from *Dipterocarpus lævis* or *D. turbinatus*, for the two species are now united. It extends from eastern Bengal to Singapore and perhaps further. The oil is abundant and is obtained by cutting a kind of well in the stem, which opening is charred around by lighting a fire inside it, and then left for the oil slowly to exude. The exudation separates into two portions, one liquid and bland, and the other thick. The quantity produced is extraordinary. The oil is extracted every year; and sometimes the same tree will have two or three cavities in it. From 20 to 40 gallons is about the quantity produced each season; but from time to time the fire has to be renewed in the cavity to char the surface afresh. When a tree in full growth is cut down and divided into pieces, a quantity of oleaginous resin exudes and hardens on the surface into something like camphor, and with a faint aromatic odor.*

The Malays call this tree Palaglar mienjak, but both in Sundanese and Javanese Palaglar is a name applied to all the species

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* As the above species (*D. turbinatus*, Gaertn.) has such interest and value a botanical diagnosis is here inserted. "The species bears terminal clusters of from three to five flowers. The flowers are hermaphrodite with a slightly concave receptacle. The calyx is formed of five sepals united into a tube at the base and very unequally developed; three of them remaining very small, while the two others grow into large oval wings above the fruit. The tube of the calyx is obconical. It is developed at the same time as the fruit and closely envelops it. The corolla is formed of five alternate petals, nearly of the same length, slightly perigynous, twisted in the bud and colored a rose pink. The stamens are indefinite, inserted on several circles. Anthers elongate, acuminate, formed of two linear cells, introrse, opening in longitudinal slits; ovary very slightly inferior to the base, trilocular, surmounted by a filiform style, entire or slightly tridentate, each ovicell with two anatropal ovules collateral with the micropyle directed upwards and outwards, inserted in the internal angle of the cell. The fruit is a pubescent spherical nut, surrounded by the tube of the calyx, with two sepals divided in large linear-lanceolate obtuse wings, with three longitudinal veins giving off laterally numerous slightly oblique anastomosing venules; pericarp dry, woody, indehiscent; seeds free, without albumen, enclosing an embryo between thick fleshy unequal cotyledons and a slightly developed superior radicle. Leaves alternate, coriaceous, smooth on both sides or a little pubescent on the veins and edges, oval or wide, lanceolate, entire or sinuate, pointed, rounded at the base, penninerved with parallel veins, petiole long, with two lateral much-developed stipules surrounding a leaf-bud and falling when it opens, leaving an annular scar." J. D. Hooker, "Flor. Brit. Ind.," pt. 2, p. 295.

of *Dipterocarpus*, and other balsamiferous trees such as several species of *Mastixia* and *Gironniera.** The balsam of *Dipterocarpus* is called Gurjun in India, and is enumerated amongst the products of India, Burmah, and the Malayan region, by various authors since the commencement of this century. Its medicinal properties were pointed out by O'Shaughnessy ("Bengal Dispensary," 1842, p. 222) as being equal to Copaiba, and as such it has now obtained a place in the Indian Pharmacopæa. Balsam of Gurjun varies somewhat in its character because it is derived from different trees of the order, all of which are more or less balsamiferous. The basis or the acid crystallised from the resin is called Gurgunic Acid by Werner, who gives it the chemical formula $C_{44} H_{64} O_5 + 3 H_2 O$ which is that of hydrate Abietinic Acid † and probably identical with that and Metacopaibic Acid.

This statement of the qualities of *Dipterocarpus turbinatus* will serve as a specimen of the whole. The balsam of *D. trinervis* is used in Java for wounds. It furnishes a dye, and with the yolk of an egg an emulsion of the same efficacy as copaiba. I have seen torches made of banana leaves smeared with this dammar as mentioned by Blume. The light is brilliant and the smell agreeable. The Camphor Tree of Borneo and Sumatra, and which I think I have seen growing in the state of Selangore also, is *Dryobalanops aromatica*, Gaertn. The product is best and most abundant where it is found in the wood. De Vriese tells us (Hook. Lond. Jour. IV. p. 33) that its price is high in Sumatra where it is called Kassa baras, and the rajahs do not care to export it, but use it to embalm the remains of royal personages. The same kind of camphor is known in China and Japan, where it is sold as a drug for a tonic and stimulant. The same tree also exudes a small quantity of aromatic or balsamic oil, called Oil of

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* *Mastixia* belonging to the order CORNACEÆ, has about six species in Java, &c., and two in Ceylon. *Gironniera* belongs to the order URTICACEÆ, with seven or eight species extending from Ceylon through the Malayan region to South China and the Pacific Islands.

† Derived from Canada balsam, an exudation from the Canadian cedar.

Camphor, obtained by incisions and collected in half-cylinders of split bamboo. After straining it is put into bottles for preservation. " *Vateria indica* is the tree from which is obtained a false resin, called Copal in India, which when fresh appears under the form of a liquid varnish called Pimen dammar or Piney varnish in British India; it is solid, tenacious, but has the inconvenience of melting at a moderately low temperature. (36·5°C.). According to Wight it is obtained by making incisions in the trunk where the liquid collects and hardens. In Malabar wax lights are made of it which give a brilliant light and exhale a perfumed odour." (Baillon, "Nat. Hist. Plants," IV. p. 219).

Formerly it was stated in most treatises on the geographical distribution of plants, that the flora of New Guinea is thoroughly similar to that of Borneo, and that its vegetation is an eastern extension of the Indo-Malayan flora. Sir Joseph Hooker, on the other hand, in denying this statement, pointed out that none of the DIPTEROCARPEÆ had been found to the east of Borneo. This, however, was equally incorrect, as I have seen the order as well represented in the Philippines, the Sulu Archipelago, and in all the islands of the Molucca Passage where I landed, including the Xulla Islands and some others down to Amboyna, as in Borneo or the Malayan Peninsula. The explorations of Beccari have also shown that a few species occur in New Guinea, but the small number of species found there (three I believe) shows a remarkable falling off from the preponderating influence of the order in the Malayan region.

Mr. Thistleton Dyer has chronicled a single endemic species in the Seychelles group, which is, to use his own expression, "like that of *Nepenthes pervillei*, an interesting connecting link between the Indo-Malayan flora and its westward outlying extensions in Madagascar and central Africa." (See "Journal of Botany" for 1878, page 98).

The order is well represented in Cochin-China, Tonquin, Cambodia, and Siam. I frequently remarked in Cochin-China large trees with the trunk blackened about a yard from the soil, with

the well-known oil-cavity. This tree, I was informed, is called "Dau," and by the French "l'arbre à huile." It is stated that the bast is the part from which the oil only flows, at least that is the Anamese idea, which is incorrect, for the cavity is always made in the heart-wood.

The order is well known in Burmah to the north of the Malay Peninsula. Here *Dipterocarpus* is one of the commonest and best known trees, and gives its name to the forests of the plains. It is called "Eng," and the Eng forests are truly the characteristic features of the Burmese region. Kurz in his "Forest Flora of British Burmah" often refers to them, classifying two parts of his botanical regions as the "Hill and Plain forests." It will help our comprehension of the Malayan flora to quote his words :—

"ENG OR LATERITE FORESTS.—The principal constituents of this forest are Byoo (*Dillenia pulcherrima*), Phthya (*Shorea obtusa*), Engyeen (*Pentacme siamensis*), Joeben (*Walsura villosa*), Moondeing (*Lophopetalum wallichii*), Myoukzee (*Zizyphus jujuba*), Lam-bo (*Buchanania latifolia*), Thit-say (*Melanorrhœa usitata*), Dan-yat (*Symplocos racemosa*), Tay (*Diospyros burmanica*), Tasha (*Emblica officinalis*), Ziphyoo (*E. macrocarpa*), Engyen (*Aporosa macrophylla*), Yemine (*A. villosa*), Yindyke (*Dalbergia cultrata*), *Wendlandia tinctoria*, Toukkyan (*Terminalia macrocarpa*), Banbwe (*Careya arborea*), Kone-pyenma (*Lagerstrœmia macrocarpa*), Khaboung (*Strychnos nux vomica*), Nabbhay (*Odina wodier*), Yingat (*Gardenia obtusifolia*), Thameng-sa-nee (*G. turgida*), Tha-byay-hpyoo (*Eugenia jambolana*), *Sideroxylon parvifolium*, Na-yu-wai (*Flacourtia sapida*), and others. The Eng (*Dipterocarpus tuberculatus*) is the characteristic tree of this forest. Moondein (*Cycas siamensis*) is plentiful in the Prome forests. Palms are represented only by a stemless Date-palm (*Phœnix acaulis*) called Thin-boung, and here and there by an erect much-reduced rattan called Kyeing-kha (*Calamus gracilis*). Of bamboo are seen only Myin-wa (*Dendrocalamus strictus*), and less so Tei-wa (*Bambusa tulda*) along the outskirts of the forest. Climbing vegetation has almost disappeared. Ferns are rare,

but Orchids and some Asclepiads are plentiful. The shrubs here are meagre and sparse, but still exhibit a great variety of species, and the same may be said of the clothing of the ground. The display of gaudy flowers during the hot season on trees as well as on the ground is often very striking. Where depressions occur, they are usually filled up with stiff clay inundated during the rains, and such places are more or less densely covered by thin dry grass and sedges."

"HILL ENG FORESTS.—These forests occupy the ridges of the outer hill ranges of Martaban and Upper Tenasserim, where they luxuriate either on Laterite formed by decomposition of the underlying rock or on débris of metamorphic rocks. In general aspect they agree with the Eng forests of the plains; but numerous trees occur in them, which are peculiar to them, or very rare in those of the plains. The Eng tree (*Dipterocarpus tuberculatus*) is still represented here, but is also often replaced by, or intermixed with, two other wood-oil trees, viz.,—*D. costatus* and *D. obtusifolius*. Other conspicuous trees are *Engelhardtia villosa*, *Quercus brandisiana* and *Q. bancana*, Pauma (*Schima bancana*), Thit-say (*Melanorrhœa glabra*), *Castanea tribuloides*, *Tristania burmanica*, *Anneslea fragans*, etc. Various trees of the true Eng forests and sometimes of the drier hill forests associate, like Doung-hsap-pya (*Callicarpa arborea*), *Dillenia aurea*, *Rhus javanica*, *Vernonia acuminata*, etc." ("Introduction," Vol. I. p. xxii).

The above descriptions of the Burmese *Dipterocarpus* forests will serve to show the unity of the vegetation; and indeed with the exception of the appearance of some new species, and the disappearance of others with no great difference between them, there is only one aspect for the flora between Borneo and Ceylon.

DAMMARA TREES AND CONIFERS.—Some of the varnish derived from the *Dipterocarpus* trees goes by the name of Dammar, which is a Malay term. There are several kinds of dammar, but the one termed Dammar puti or batu (white or stone dammar)

is derived from a coniferous tree, which takes a leading part in the formation of forests on the mountain. In ascending to the summits of any of the high hills, one is sure to notice, round the stems of certain stately-looking trees, deposits of yellowish white resin. This comes from a tree which is a near relation to the Pines and *Araucarias*, but differing in appearance from any of them except in this that wherever the bark is wounded quantities of the resin exude. "The Dammaras are distinguished from the true Pines and Firs by their broad, opposite or alternate, oblong-lanceolate, attenuated leathery leaves, with parallel veins, and in the male and female flowers being solitary and on separate plants: they however approach nearest to the genus *Araucaria* in being diœcious, but from which they differ in the form of the scales, in the absence of a bractea to each female flower, and in the seeds being winged only on one side, and free or unattached." ("Pinetum, A Synopsis of all the coniferous Plants." By Geo. Gordon, 3rd ed. p. 108). There is only one species, which is a tree growing upwards of 100 feet high, with a straight, smooth bark and trunk, from eight to ten feet in diameter, found on the summit of the mountains of Amboyna and Ternate, and in many of the Molucca Islands, Java, and Borneo. Timber of little value, but producing a fine transparent resin, and esteemed by the natives for incense. There is a variety having longer and more lanceolate leaves with the edges rolled on the under side, slightly undulated, whitish, and tapering to the point, and with the bark on the branches of a whiter colour.

Europeans distinguish the resin of *Vateria indica* as Piney dammar, that derived from *Shorea* and *Hopea* as Dammar simply, like the conifer, while the resin of *Dipterocarpus* is distinguished by the Indian name Gurjun, and that of *Dryobalanops* as Camphor. No distinction is made in the uses to which these resins are put except the camphor. They are largely employed for caulking boats, and with the oil are combined for making various varnishes.

MELASTOMACEÆ.—Another of the remarkable and common members of the flora of the Malayan Peninsula is this order. They are plants of warm climates, few extending into the sub-tropical regions. Generally they may be distinguished by their remarkable opposite leaves, which have five to seven deeply impressed curved longitudinal veins, and with long beaks to the anthers. The prominence of the lateral ribs in the leaves gives these plants some resemblance to species of MYRTACEÆ; but with a few exceptions, the leaves of the *Melastomas* are without transparent oil-glands.

Out of 134 genera in the order, 29 are found in the Malay region; the rest belong principally to South America, excepting a few in Africa and Polynesia. The order is divided into three sub-orders, namely, MELASTOMEÆ, ASTRONIEÆ, and MEMECYLEÆ. The first has no less than twelve tribes, the first of which (Microlicieæ) is almost confined to America; the second (Osbeckieæ) has 29 genera of which three only, *Osbeckia, Otanthera* and *Melastoma,* are represented in the Malay Peninsula, but these rather extensively. The Rhexieæ and Merianieæ with ten genera are American; the Oxysporeæ with ten genera is scattered over a large area between Madagascar and Japan; the tribe Sonerileæ with 13 genera has representatives in Asia, Africa and America, and throughout a large area. The tribe Medinilleæ with eleven genera has nine of them represented in the Malay Peninsula and one of them (*Medinilla*) with many species. The Miconieæ with 30 genera belongs almost exclusively to tropical America, and so does the next tribe, Blakeæ. The other two sub-orders have only six genera. The ASTRONIEÆ with four genera is almost exclusively Malayan with the exception of a few species in the Pacific region. The last sub-order, MEMECYLEÆ, has only two genera, both of a decidedly aberrant type. One, *Mouriria,* has thirty species, all American; the other, *Memecylon,* with a hundred species, in Asia, Australia, the Pacific Islands, Ceylon and Africa, but all within the tropics.

The order is closely connected with that of the Myrtles, which, as most readers are aware, consists of trees and shrubs usually

with opposite entire leaves marked with translucent dots. The stamens are indefinite. Not only, however, is there the closest relationship between the two orders, but they pass into one another, so to speak, in the genera *Blakea, Astronia,* and *Mouriria. Mouriria* has no ribs on the leaves, which are very distinctly dotted. *Diplogenea* shows also some signs of dots, while *Memecylon* has no lateral ribs, neither has the large genus *Sonerila.*

There is a strong resemblance also between the two orders in the variations to which the typical structures are subject. To mention no more than the leaves, we find almost every variety of form amongst the Myrtles, such as in the genus *Calythrix* where they are scattered (not opposite), small, semi-terete, three- or four-angled, rigid, and as unlike the leaves of a myrtle as possible, to the showy coriaceous forms amongst the *Eugenia, Tristania,* &c. In the MELASTOMACEÆ there is just as much variety, which seems to follow the same lines. The characteristic leaf-structure in some of the South American species disappears. For instance, in the genus *Fritzschia* the leaves are small, coriaceous, sometimes dentate, and with impressed dots; in *Lavoisiera* they are small and decussately imbricated; in *Marcetia* small and heath-like, and so forth.

It would seem as if the MELASTOMACEÆ are, in the Malaysian region, what the MYRTACEÆ are in Australia within the tropics, where they do not prevail over other forms of vegetation to the extent they do in temperate regions. The genera of Myrtles with fleshy fruits are the members of the order best represented in the Malaysian region, but in Australia such are almost entirely confined to the tropics. On the other hand, the characteristic MYRTACEÆ of Australia are those with capsular fruits, and they are nearly entirely confined to that continent, though there are a few stragglers to be found in the flora we are now considering. There is a *Metrosideros* in the Malayan Peninsula, and I found on the summit of Gunong Bubu a *Leptospermum* and a *Leucopogon.* The MELASTOMACEÆ of Australia are few in number, not exceeding five species, belonging to four wide-spread genera, namely,

Osbeckia, *Melastoma*, *Otanthera*, and *Memecylon*. One species of *Osbeckia* common in Malaysia extends to Australia. The Australian *Otanthera* is wide-spread in the Indian Archipelago, and *Memecylon umbellatum* was also recognised in the Peninsula. *Melastoma* is the only species of the order which extends outside the tropics in Australia.

The useful properties of this order are few. They are generally astringent, and one or two produce edible fruits. Black and yellow dyes are extracted from the berries of American and Malaysian species. The leaves of *Melastoma malabathrica* are said to be efficacious in dysentery. *Astronia papetaria* is a Malayan species with sub-acid leaves, and is cooked with fish. It is called Obat papeda.

Most of them have showy blossoms of pink and violet tints, which are a great embellishment to the vegetation of Malaysia. Some species of *Medinilia* are climbers and cover the trees with a profusion of scarlet blossoms, while the stalks of the whole raceme are a brilliant coral red, carmine or pink. See Curtis's "Botanical Magazine," where there are beautiful figures of *M. speciosa*, *M. magnifica*, *M. javanensis*, *M. curtisii*, *M. amabilis*, and some others.

Palms.—This natural order in Malaysia requires a special essay to itself to do it justice. The whole scenery of the Malayan region is modified and characterised by its palms. It is usually a fringe of Cocoa-nut Palms which lines the coast. Even where the Mangroves form a soft green margin, the Cocoa-nuts project their feathery heads above the line of trees and give a tropical character to the scene. Cocoa-nut Palms are soon discovered to be everywhere. They line the coast, they crowd the valleys, they shade the sand-hills, and they form the borders of both the roads and the garden enclosures. There are plantations of this palm besides, near the towns, where nothing else grows by its side except the Betel Palm. And this also grows everywhere. It is just as well that it is so, for the Cocoa-nut Palm is apt to become

straggling, and its stately dignity much impaired by its faded look. Betel Palm is gracefulness itself. Tall, slender, fresh-looking and green, with a close luxuriant tuft at the summit of arched or straight leaves, it forms one of the very agreeable embellishments of the tropical flora. The foliage is like a plume of feathers around a warrior's helmet as it waves to and fro in the breeze. It is seen almost everywhere, and is always an index of cultivation. In wandering through the jungle when one gets a sight of Cocoa-nut Palms or Betel Palms, one may be sure that there is, or there has been, a native settlement in the locality.

Everyone knows the purpose for which Betel is culivated. The seed is cut into small slices, mixed with lime and wrapped up in a leaf of Sirrih or Betel pepper, and is chewed by the natives. It is an acquired taste, and one would say not easily acquired, yet the practice is universal, and the natives would forego anything rather than this luxury. A curious fact connected with the Betel is the uncertainty about its habitat. Somewhere in Malaysia, is the conclusion arrived at, but one never sees it in a wild state. The Chinese historians state that it was received from the south B.C. 111 years, and then it bore the name of Pinlang; now, the native name is Pining; in Javanese, Jambi; in Balinese, Banda according to Crawfurd, who also says the Bugis call it Rapo; in Tagalo, Bonga and Bongang-pato, also Sacsic. In all the Philippine dialects it should be remarked, however, that Bonga means simply a fruit. The Sanskrit name is Gouvaka (de Candolle). The Telinga name, Arek, is the origin of the botanical name *Areca*, while Betel is the Malabar name. In Hindostanee it is called Paunsooparee or Paun, but this refers to the prepared state of the Betel-nut, lime and pepper leaf.

The spathe of the leaf contains valuable fibre deserving the attention of paper-makers. The Chinese storekeepers in Singapore and Penang use it for packing, and in India it is employed for many purposes, even water-vessels, caps, umbrellas, &c. It has a fine surface like paper.

Borassus flabelliformis, or the Palmyra Palm, is seen sparingly near the coast in the Malay Peninsula. It is not common any

where in this region, but most frequent in Java. The leaves are over eighteen inches in diameter, folding and opening like immense fans. The upper enamelled surface is written on with an iron stylus, and forms the Balinese books, remaining in good preservation for hundreds of years. The ribs being of cane give great strength to the leaf. Cut off at the stem, the thicker part of the fan is bent round, making a powerful helmet used by fighting men, and as a protection for those who force their way through the jungle, for which the wedge-like form is admirably adapted. Furthermore, it serves as an umbrella. It is said to yield its fruit only when the tree is eighty years old, when previously a flower, about thirty feet long in large trees, bursts forth with a loud report. Its perfume is overpowering, which causes the natives to destroy them. This tree is used for the production of sago from its pith, but only in times of scarcity. The leaf-stalks yield a wiry fibre about two feet in length, made into rope occasionally. A fine down is collected from the base of the leaves, valued for staunching wounds and straining liquids. In Bengal the juice is fermented for toddy, and is used for yeast and yields a sugar of grey colour. A more common and more valuable palm is the Gomuti, Jaggery, Kabong, Areng or Aju, known to Europeans as the Sugar-palm and to botanists as *Arenga saccharifera.* It is a magnificent tree, with close long pinnæ on the leaves, less stiff and regular than the Cocoa-nut Palm. There is more than one species of Areng extending to nearly 3,000 feet above the sea level, but the Sugar-palm loves low moist situations, and is quite content with the poorest soil. It vies with the Cocoa-nut Tree in utility. In Java it is common on the road-sides in the mountains, but not so common anywhere as it ought to be. It produces valuable supplies of sugar, fibre, spirit and sago, but the sugar is the great production. This is yielded by the male spadix (in Malay Mayam), but not before the tree has attained its seventh year, and even then male spadices are rare or absent; but if absent the tree is abundantly rich in sago. The Mayams, both male and female, have a handsome appearance as they hang down in clusters or strings of rich-looking buds. Curious things are related of them, such as, that each new sprout-

ing of Mayam is lower and lower, and till the last comes forth at the root of the tree and it then dies. Generally two male spadices come forth at a time and they yield juice from three to five months, and, ere they cease, their places are supplied by fresh ones. When the flower opens the spadix is cut at the base, and tubes of seasoned or smoked bamboo (from which the upper phragmata are removed, making a long vessel), are applied. As they fill the juice is poured into earthen jars, and evaporated in iron pans over a fire until nothing but grain-sugar remains.

If toddy be wanted, the spadix is tied at the base and beaten with a small stick for two or three days in succession, and the juice collected in the usual way. It is left in jars until fermented, in which state mostly it is taken by the natives. In the Philippines it is consumed largely and I believe to intoxication. I have seen the natives lying about in a stupid state of inebriation from its use, especially the old men. It has a flavour which suggests beer, vinegar and malt, while there is a general aroma recalling the smell of a brewery and mouldy wood. A powerful spirit is distilled from it, largely used by the Chinese in Malaysia, and to some extent abused also.

Dr. de Vry, a Dutch naturalist from Batavia, strongly recommends the employment of *Arenga* for the sole production of sugar; as he says the tree takes nothing from the soil, while beet and cane utterly exhaust it. He calculates that three quarters of an acre planted with Gomuti should yield annually 2,400 kilogrammes of sugar in a soil quite unfit for any other culture. I am not aware of the number of trees or their distance apart in the supposed area.

The Jaggery also produces sago; in fact no other tree is the source of it in Java; but it is dark in colour, of poor quality and small in quantity in proportion to the yield of other palms. In Sunda it is the only sago offered in the markets; but in eastern Java other kinds are imported.

The enumeration of the useful qualities of this Palm-tree is not yet finished. The stem of young trees is wrapped round in the leaf-sheaths, the sides of which afford a black fibre like horse-hair, to

the extent of about three-quarters of a pound to each leaf. This falls away of itself and is easily collected without injury to the tree. Some is coarse like elephants' bristles, and some so fine as to be good for stuffing beds; but the greater part is like horse-hair, making a beautiful rope. It bears a greater strain than coir, and loses less weight than coir, hemp or Manila hemp, as it requires no preparation for manufacture, and water has no effect upon it. It would be superior to every other kind of fibre for ropes, were it not that it is not sufficiently elastic for anything but standing rigging, cables and such-like purposes.

I conclude this summary of the value of Gomuti with the words of Dr. Roxburgh: "I cannot avoid recommending to every one who possesses land in India, particularly such as is low and near the coasts, to extend the cultivation of this useful and elegant palm, as much as possible. The wine itself and the sugar it yields, the black fibres for cordages and cables, and the pith for sago, independent of many other uses, are objects of very great importance. From observations made in the Botanic Gardens at Calcutta, well-grown thriving trees produce about six leaves annually, and each leaf yields from eight to 16 ounces of the clean fibre. They are in blossom all the year; one lately cut down yielded about 150 lbs. of good sago meal."

Sago Palm.—In 1475, Marco Polo wrote as follows:—"And I will tell you another great marvel; they have a kind of tree that produces flour, and excellent flour it is for food. These trees are very tall and thick, but have a very thin bark, and inside this bark they are crammed with flour." This is the first accurate description of the *Sagus lævis*, Reinw., by that most accurate and painstaking of travellers. Twenty feet is about the average height, and the tree is generally surrounded by numerous young plants. The stem is very thick with annular leaf-scars on the upper part. The leaves are like those of the Cocoa-nut but grow more erect; they are pinnate, unarmed; leaflets linear, acute, carinate and smooth. This tree is not matured till it is about seven to 20 years old; the fructification then appears and it soon

after decays and dies. The inflorescence is terminal; several spadices rise from the summit of the stem, enveloped in sheaths at their joints, and are alternately branched. The flowers and fruit, generally five to eight inches long, are produced on these branches. They are brown, closely imbricated with broad scariose scales, within which is a quantity of ferruginous flocculent fibre or wadding, in which the minute flowers are embedded and completely concealed. Each scale supports two flowers which are hermaphrodite, and scarce larger than a grain of turnip-seed. In habit and character this tree differs much from all palms, and its propagation by radical shoots like the Banana is not observed in any other species. The terminal blossoms and the death of the tree after fructification are other peculiarities. The fruits are retroversely imbricated like the rattans or *Calamus*. In its young stages the stem is covered with sharp thorns, no doubt to protect the tender tree from destruction, as they fall off subsequently. It grows best in muddy marshes, and will not do well anywhere else. The sago must be gathered before the fruit forms, as then the stem consists of a thin wall enclosing a wide mass of pith. This is the flour which requires other preparation before it becomes an article of export. The natives call it Sagu. It is eaten with palm-sugar and forms a dish called Santan, very luscious and nourishing with cocoa-nut milk (the juice of the nut expressed with water, not the contained fluid), but probably too sweet for European palates. The flour is also baked in biscuits which keep well. The fruits of the tree are eaten and easily preserved, 30 baskets being no uncommon harvest for one tree, and a basket giving ample nourishment to a small family for a week. Neither fruit nor sago is much used by the natives except in Celebes, and the Philippines and Moluccas.

It would be useless to enter into detail on the mode of preparation, which is described by so many authors. At present the product gives rise to industries in many parts of the Indian Archipelago, particularly Malacca, Sumatra, certain parts of Perak, Selangore, Borneo, &c. In Singapore there is an extensive trade in sago, whence it is exported after being bleached and

pearled for the European market. When I was in Borneo there had been a great advance made in the sago trade, through the influence of the North Borneo Company, owing to the efforts of the Government of Sarawak, and arrangements between Labuan and the Sultan of Brunei. At the latter city I met with a few Europeans who were trading with certain Chinese merchants and manufacturers in Brunei for sago. I visited one Chinese establishment where there was rather a small plant for bleaching and pearling, and I heard of others; but owing to the unsettled state of affairs, and the war between the Sultan of Brunei and the Kadyans, there was a general exodus of Europeans from the kingdom.

Crawfurd states that by far the best and fullest account of the culture and manufacture of sago is given by Mr. Logan in Vol. III. of the "Journal of the Indian Archipelago;" but readers will do well also to consult Simmonds' "Tropical Agriculture" (London, 1877), and Spon's "Encyclopædia of Manufactures and Raw Materials" (London, 1882) for an account of the cultivation.

The following quotation from Logan deserves insertion:—"When a plantation has once arrived at maturity there will be a constant harvest, because the natural mode of growth secures a continued succession of new plants from the time those first planted have begun to extend their roots, and this succession can be regulated by the knife in any manner the planter desires. The Sago Tree, when cut down and the top severed from it, is a cylinder about 20 inches in diameter, and from 15 to 20 feet in height. Assuming 20 inches as the diameter, and 15 feet as the height of trees, the contents will be nearly 26 bushels, and allowing one half for woody fibre, there will remain 13 bushels of starch, which agrees very closely with our previous calculation of 700 pounds for each tree, or 12½ bushels. It may give some idea of the enormous rate of this produce if it be considered that three trees yield more nutritive matter than an acre of wheat, and six trees more than an acre of potatoes. An acre of sago, if cut down at one harvest, will yield 5220 bushels, or as much as 163 acres of wheat, so that according as we allow 7 or 15 years for

the growth of a tree, an acre of sago is equal in annual produce to 23 or 10 acres of wheat." ("Journal of the Indian Archipelago," III., p. 312).

The manufacture of pearl sago by the Chinese is described fully in the works already cited. Though *Sagus lævis* or *S. kœnigii* is the species most used for the production of the farina, there are probably three or four species and a number of varieties known to the Malays. There is what is called a bastard sago, derived from the Toddy Palm (*Caryota urens*), a native of the mountains of India and Ceylon. Another sago is made from a distant relation of the palm family in Japan (*Cycas revoluta*). There is also an extensive trade in Brazilian sago, derived from *Copernicia cerifera*. *Cycas circinnalis* yields sago in Malabar and Cochin China.

A few words more about some well-known species in Malaysia must conclude the references to the palms. Certain species frequent certain altitudes. In an expedition to Gunong Bubu I met with three palms clothing the mountain side, almost to the exclusion of any others up to about 3,500 feet. For the first 2,000 feet we had the usual mountain species of *Arenga*, *Areca* or Betel, and *Ptychosperma*, with occasionally the less common genera of the plains. At 2,000 feet or so we began to meet with abundance of *Pinanga*, or *Ptychosperma*, with which genus it has been united. The large pinnæ were especially useful for roofing our temporary huts. They are unarmed, often arboreous palms or shrubs, sometimes with creeping stems. There are several species such as Pinang boreng of Malacca, and Kurdu at Penang. Many persons think that this particular species produces those formidable palm-tree bludgeons which are known in the Straits Settlements as "Penang lawyers;" but it cannot be the Pinang boreng which is *Areca (Pinanga) malayana* (Mart. Palmæ, p. 184, pl. 158, fig. 3, and Griffith, " Palms of Brit. E. India," p. 152, pl. 230). It is an elegant palm eight to twelve feet high, with a distinctly annulate stem scarcely an inch in diameter, and a crown of five to eight spreading leaves with stalks a foot and a-half long, while the

alternate linear pinnules are one and a-half to two feet long; upper pinnules cuneate and deeply bipartite.

Above this region of *Pinanga* is the Bertam Palm, a stemless species, growing in thick tufts which are surrounded by the withering fragments of old leaves. This is the *Eugeissona triste* (Griffith, p. 110, pl. 220, A. B. C.) The leaves are numerous, the outer ones spreading, and fifteen or twenty feet in length. The stalks throughout the lower seven or ten feet are roundish, armed with brown, flat ascending thorns; but between the pinnules they are triangular and unarmed; the pinnules long and narrow, 25 or 30 inches in length. This is one of the most useful of palm-trees and in its industrial application it divides the honours with *Nipa fruticans.* Most of the partitions of houses are made of it, and often the walls; while the leaves with the pinnules plaited over one another make a very effective roofing. It is common everywhere in the Straits Settlements, and adds much to the impenetrability of the vegetation. The Bertam continued up to about 3,000 feet and then we had nothing but *Licuala.* These were very handsome trees even though they are almost stemless, but as the leaves are fan-shaped or sometimes circular the appearance is very elegant. The natives call them generally by the name of "Plass," but most of the species occur on the lower grounds in wet places. Here, however, I met with them on dry slopes, altogether above the usual region of palms, and this was quite a discovery. The leaves were circular and peltate, and I have little doubt that this was *Licuala peltata,* a species peculiar to the woody mountainous country of the Himalayas below Darjeling. I never saw it anywhere except on this mountain, nor below a height of 3,000 feet; but I must add that my experience of mountain ranges was somewhat limited in the Malay Peninsula. Griffith says that this is the largest and finest species of the genus, and not likely to be confounded with any other. Its large peltate orbicular leaves, simple, large pendulous spikes, and comparatively very large flowers will at once distinguish it. In its leaves it resembles *L. longipes*, but that is an almost stemless palm, while this, though a low species, has a stout stem

three or four feet high, marked below with leaf-scars, but above the base of the petiole is persistent. It is used as an umbrella or parasol, and is called on that account the Chattah pat, chattah being an umbrella in Assam. The demand for them is great; scarcely a single ploughman, cow-keeper, or coolee but carries a sunshade made from this tree in Assam; but in Malaysia it is not so used.

Licuala acutifida, or, in Malay the Rat-plass (*Plass tisku*), appears to be the plant supplying the "Penang lawyers." It is a small miniature palm, the trunk being only from three to five feet high, though specimens may be obtained 15 or 20 feet in height and about two inches in diameter at the base, marked with incomplete rings to which fragments of the leaf stalks adhere. Some think that the best of "Penang lawyers" are those which are stoutest and most bludgeon-like; but this is not the case, because of the way in which they are prepared. Nearly the whole of the outer layer is removed almost to the pith by scraping and polishing. They thus become brittle and easily decayed. The thinner sticks are much more valuable and are more rare. Scraping and straightening over a fire is the only preparation these sticks appear to be subjected to. The species is not common and has a restricted habitat, though probably not entirely confined to the neighbourhood of Penang or the province of Wellesley.

On the borders of paddy-swamps throughout the Peninsula there is a very elegant palm 30 or 40 feet high, annulate, and each ring beset with spines with a dense and graceful foliage. This is the Nibong Palm of the Malays, or *Areca tigillaria*, not to be confounded with Nibong Paday, or *A. horrida*, common on the cliffs of the sea-shore a little to the north of Kundur, near Malacca. The first species mentioned is much in request for door-posts. Nibong tubal is the name of a somewhat large village (tubal, thick) in the province Wellesley.

Orania macrocladus, the Daun daun or Ebul of the Malays, is a handsome palm about 40 feet in height resembling a Cocoa-nut

tree. It is common in the forests at Ching, near Malacca, and met occasionally in the Peninsula and in Singapore Island. *Caryota urens*, or the toddy-palm, is met with in situations which suggest former cultivation, besides *C. sobolifera*, *C. obtusa*, and *C. cumingii*. I am not aware that the natives make any use of these trees. *Ptychosperma singaporensis*, a species which closely resembles the common palm found on the north and east coast of Australia down to lat. 34° south, is frequently met with in the Peninsula, in fact is the most abundant of indigenous palms. Another species, *C. coccinea*, is rather rare. *Cyrtostachys rendah* is one of the ornamental palms in the jungle of the Peninsula. The Malay name is Malam waren. It has a beautiful red hue, and though not ever assuming the proportions of a tree, its pinnate fronds are disposed in such a way as to render it very elegant and graceful. When in Labuan, Borneo, I saw this species growing apparently wild in the jungle close to Government House.

CUPULIFERÆ, AMENTACEÆ, OR CORYLACEÆ. — Chestnuts and Oaks form a considerable portion of the indigenous flora of the mountain forests, extending at least up to 3000 feet. The species are numerous, and probably many are undescribed. The Oaks differ from the European species. The acorns are mostly depressed, round and oval, so as to form almost a disk an inch or two across, and the cup is either covered with imbricated scales or overlapping lines of the involucre forming a series of rings. A figure of one of these is given at the end of the chapter. I am not aware that any of the species are valued amongst the Malays on account of the timber they yield. The species of *Castania* or Chestnuts are nearly as numerous as the Oaks, if not quite as many. They have been divided into two genera by some authors, namely, *Castania* and *Castanopsis*. The distinction is derived from the ovary and the involucre. In *Castanopsis* it is 3-locular, and the spinous involucre altogether encloses the fruit, finally splitting open irregularly. In *Castania* the ovary is 6-locular, and the thorny involucre includes one or two nuts, and opens

regularly into two or four valves. *Castanopsis* includes all the species found in the oriental region, 24 being enumerated between India, China, and Malaysia; in fact there is only one other. According to Bentham and Hooker there are but two species of *Castania*, one of which is the well-known edible Chestnut. No true *Castania* therefore exists in the Malay Peninsula. *Castanopsis argentea* occurs as high as 6,000 to 7,000 feet in Burmah. The timber is valued to some extent, especially in Java, and the fruit is used in the same manner as the European Chestnut. Sanienten appears to be the Malay name, and Tangogo in Sunda. In Tagalo and Visayan Oaks are called Olayan, Hayopag, Macabingao, Mangasariqui, Cacana, Palayen. The *Castanopsis* in Tagalo is Talacatac and Tacatac. There are but two or three species of *Castania* in the Philippines, and the Oaks are somewhat more numerous, but they do not occupy so important a position in these islands as they do in Malaysia. Nearly all the fruits of the Chestnuts of the forest are used as articles of food, in Java and Sumatra especially, but they are not cultivated.

Creeping or Climbing Plants.—The vines of the jungle form so large a portion of the vegetation that to enumerate even a fair percentage would far exceed the limits of this essay. Only a few of the leading genera can be mentioned, for the climbing shrubs range through every natural order, not even excepting the Cryptogams. *Lygodium scandens* has already been mentioned. *Freycinetia* is a common climbing Screw-pine, *Calamus* a climbing Palm, and *Vanilla* a climbing Orchid; and as for the climbing Aroids they are innumerable. This will serve as a specimen for the endogens. As for the exogenous climbers only a very few can be named. Several species of *Cocculus* and *Anamirta* are common. The latter is the source of the bean *Cocculus indicus*, used in beer to increase its stupefying qualities and as a fish-poison. *Cocculus glaucescens* is another common species, the fruit of which is eaten readily by the natives and is said to be agreeable and refreshing. *Naravelia zeylanica* is an inconspicuous climbing

plant of the order RANUNCULACEÆ, with star-like yellow flowers, distinguished from *Clematis* by the presence of petals. It extends through all the Eastern Archipelago. *Delima* or *Tetracera sarmentosa* is universally met with, belonging to the order of DILLENIACEÆ, already referred to as used by cabinet-makers as a substitute for sand-paper; besides several fir-trees. *Tinospora crispa* and *Cissampelos paraira* are two other climbers belonging to the MENISPERMACEÆ. The first yields the Galuncha drug to the natives of the Indian Peninsula, who attribute to it many medicinal virtues; the second produces the Portuguese remedy known as Pareira-Brava. *Fibraurea tinctoria*, another member of the order, called Akar by the Malays, is common, yielding a dye from its root. *Schizandra marmorata* (MAGNOLIACEÆ) is a somewhat rare climber with red, yellowish, or white flowers: an infusion of the roots is used for dysentery or colic.

The climbing Leguminosæ are very numerous. The large pods of *Entada scandens*, which contain beans made into match-boxes both in the Straits Settlements and in Australia, are common. The appearance in the jungle of the skeleton pods is very peculiar, as the sutures of the coriaceous pod remain upon the tree after the seeds have fallen away, looking like a miniature ladder. It is widely diffused over tropical Asia, Africa, and the West Indies, the seeds being carried by ocean currents without losing their power of germination. *Derris scandens* and *D. uliginosa* are tall woody climbers distinguishable by the sutures of the flat pod being bordered by a narrow wing, with white or yellowish axillary racemes of flowers. Both species, wide-spread throughout the Archipelago, are used as fish-poisons. *Canavalia obtusifolia* has the stems more frequently prostrate and trailing than twining, with white or slightly pink flowers and winged pods, but distinguished from *Derris* by having pinnate leaves with five or more leaflets, and a divided reputation either as an esculent or a virulent poison. *C. ensiformis* can certainly be used as an esculent, as the leaves, pods, and unripe fruits are cooked by the Malays with rice and eaten. Among the Cæsalpineæ three or

four if not more species of *Bauhinia* are commonly met with. *B. tomentosa* affords a remedy for dysentery, while the seeds afford the medicine named the Downy Mountain Ebony Oil.

The PASSIFLORACEÆ are well represented by climbers in the jungle including *Passiflora fœtida*, as well as *Modeeca obtusa* with its large scarlet capsule, which is common and brilliant. CUCURBITACEÆ will be easily recognized by their gourd-like fruits, including the Gourd itself (*Lagenaria vulgaris*), which grows wild in the jungle as it does in North Australia. It is not very palatable, but still the natives use it as food, and uncooked the pulp is taken as a purgative. Most botanical works state that it is poisonous, but this is incorrect. *Momordica balsamina* is widely spread, and is conspicuous from its long fusiform bright yellow fruits, which bursting disclose the seeds enveloped in a brilliantly red pulp.

True Vines of the natural order AMPELIDEÆ are especially common, including *Vitis elegans*, *V. hookeri*, *V. gracilis*, *V. semi-sagittifolia*, *V. trifolia*, *V. lanceolaria*, *V. capriolata*. They all have fruits, and some, large bunches of a very enticing-looking grape, but generally astringent and nauseating. *Pæderia fœtida* and *P. tomentosa* are common, the former with its fetid odour being unmistakable. Three species of *Willoughbeia*, (*W. firma*, *martabanica* and *flavescens*) represent the scandent Dog-banes, with very large apple-like fruits, said to be good eating; but the order is a suspicious one. *Ichnocarpus frutescens* is another of its members. Passing from the Dog-banes to the ASCLEPIADEÆ we find a larger allied order more extensively represented, including as common members of it, *Streptocaulon banmii*, *Tylophora tenuis*, *Gymnema syringifolium*, and the *Hoyæ* or Wax-plants (*H. pratense*, *H. imperialis*, *H. lacunosa* and *H. carnosa*) distinguished by their fleshy wax-like leaves and clusters of beautiful fragrant flowers. These plants prefer to grow like Orchids on rocky outcrops. The LOGANIACEÆ are also represented by climbing *Fagræa*, notably *F. auriculata*, a fragrant species with cream-coloured flowers fully five inches across. *Strychnos colubrina* is a climber everywhere

abundant, with poisonous qualities which seem to be well-known to the Malays.

The CONVOLVULACEÆ are amongst the principal adornments of the jungle, from *Ipomœa bona-nox* with its large white salver-shaped flowers to *I. quamoclit* with small brilliantly carmine blossoms and leaves with minute pinnæ. There are also representatives of the order all through the jungle, of which *I. pes-tigridis* is the most common; it is found everywhere, with its five-lobed palmate leaves and funnel-shaped purplish flowers, twisted together so as to form ropes which strangle many a fine young tree. The species (a variety) is equally common in Hong Kong.

The BIGNONIACEÆ are not well represented in the Malayan flora; but observers will be sure to notice *Bignonia ungua* which is common everywhere. Almost as common is *Grewia umbellata*, a tiliaceous climber of which there are others in the jungle. *Hexacentris mysorensis* is an ornamental climber of the order ACANTHACEÆ. It has dentate leaves and many-flowered axillary racemes of handsome blossoms. A *Smilax* or two, which the Malays call Pina-pina, contribute their tendrils and binders to the tangled intricacies of the Malayan thickets. Finally two Aroids are noticeable by the way they grow up the stems of trees and clasp them with the tenacity of the ivy of Europe. One is *Pothos loureiri*, a smooth climber with the leaves usually arranged longitudinally in two rows on the opposite sides of the stalks. The leaves moreover have the blades fixed by a joint to the stalk, and the stalk itself is spread out like a leaf. The species is in Australia, the Philippines and south China, as well as Malaysia. The other Aroid is *Rhaphidophora pinnata*, which climbs on trees, rooting in the lower part of them; but the leaves are deeply lobed, often three feet long and one broad, the segments being narrow and curved, with more or less incurved points. This species is called by Europeans the Climbing Fern, and is found in Australia as well as in the South Pacific Islands.

PARASITES OR EPIPHYTES.—Plants growing on others and deriving nourishment from their sap, or plants which grow on the

surface of others without deriving anything from them, are extremely common in this region, especially if we include the Fig-trees. But even exclusive of the Figs, the Mistletoes and similar plants, such as *Viscum*, *Ginalloa* and *Anginalloa*, are abundant in the jungle. The species of *Viscum* or true Mistletoe which are found in the Indian Archipelago belong to the leafless group, and these, like those of Mauritius and Australia, *V. compressum* and *V. ramosissimum* are common with *Loranthus tetragonus*, *L. formosus* and over twenty other species on different trees. This exceedingly difficult genus has its species so closely resembling one another, and so many varieties that they require great experience to distinguish them, especially where they are so numerous.

Orchideæ.—There is no department of the vegetable kingdom that attracts so much attention in Malaysia as this natural order. They are interesting in their habit; they grow so easily, requiring little attention, and can be put almost anywhere, and they often produce flowers pre-eminent in their form, colour, and fragrance, that nearly every one collects them amongst the European residents. They hang them in their verandahs or amongst their flower-pots, and are often rewarded by seeing the fairest blossoms open from what look like dry and shrivelled stems and roots. Scarcely a bungalow in the European quarters but contains a goodly show of these odd plants, though they are not ornamental unless when in flower. Yet it may be questioned whether there are many who make these collections who have the most elementary knowledge about the nature of the plants. They would find it extremely difficult to give a definition of what an Orchid is. Most amateurs believe that their epiphytic character is a distinctive mark belonging to the order. This is not a matter of surprise in Malaysia, where ground Orchids are rare, and nearly all the species are epiphytal, or grow on stones. The fibrous roots in bundles which clasp the stems of the trees to which they grow, or which hang loosely in the air, or are fleshy tubers and filled with granules of bassorin (a soluble gum like tragacanth), are marks distinct enough in the eyes of amateurs

in Malaysia to denote an Orchid. The irregular flowers, however, demand a word of explanation. They differ from the plan which prevails in the vegetable kingdom, and their organs are arranged on a uniform plan of their own. This consists of three sepals, between which are three petals, the two lateral ones similar, and like the dorsal sepal, so called because it is placed at the back of the flower. The third petal is the largest, and differs in shape and has various appendages. Instead of having a style and stamens like other flowers there is a body in the centre called the column. The pollen is in wedge-shaped masses, two or more in number, detached, or adhering by a stem. The stigmas are confluent, in a hollow mucous disk. The ovary has one cell opening eventually into six dry woody valves with horizontal cells, three of which contain minute seeds in a loose netted skin. The special peculiarities of the order are :—(1) the union of the stamens and style into the column ; (2) the suppression of all the anthers but one (except in *Cypripedium*) ; (3) the peculiar condition of the pollen ; (4) the development of one of the petals into a large and peculiar form.

Orchids are divided into seven tribes thus :—three with pollen masses, namely, (1) MALAXIDEÆ, with no stem or caudicle to the pollen masses which are immediately applied on the stigmata ; anther hanging down like a lid, usually deciduous (two, four, or rarely eight) ; (2) EPIDENDREÆ, pollen masses with caudicle, but no separable stigmatic gland ; (3) VANDEÆ, pollen masses in two pairs on a single or double caudicle attached to a gland. Four tribes have powdery or granular pollen, namely, (1) OPHREÆ, anther terminal, erect ; (2) ARETHUSEÆ, anther terminal, lid-like ; (3) NEOTTEÆ, anther dorsal ; (4) CYPRIPEDEÆ, anthers two.

Orchids are tropical in this sense that they are more numerous in tropical regions than elsewhere. The MALAXIDEÆ prevail principally in the Indian continent and Malaysia, being less numerous in tropical America and the islands of South Africa. They extend likewise to Australia and the Pacific Islands, but are completely absent from the Mediterranean, extra-tropical

America, and the Cape of Good Hope. They have a large number of genera, the most notable of which are *Dendrobium* (a very large genus generally belonging to Malaysia, the majority with purple or yellow flowers, some remarkably showy and some of delightful fragrance); *Dendrochilum* (a small Malaysian genus on branches or trunks of trees, with bulb-like roots and a single shiny leaf and long spikes of small white and yellow flowers, some like lilies of the valley and very graceful); *Aporum* (flowers small and of no great beauty); *Bolbophyllum* (a large genus of small size on trees or rambling on the ground amongst mosses, with one leaf, a kind of bulb with small fleshy deeply-coloured flowers, in dense spikes occasionally); *Cirrhopetalum* (another genus with solitary leaves and pseudo-bulbs, with the lateral sepals of the flowers prolonged into narrow streamers, hence the name); and *Eria* (likewise a large genus with flowers sometimes remarkable for their fragrance, but not of great beauty. It takes its name from the Greek ''εριον, wool, because many species have the flowers clothed with white down).

The EPIDENDREÆ are epiphytes rarely having fleshy roots, conspicuous for large coloured membranaceous flowers, with a great lip curved in like a hood, bearing fringes on its veins, and a broad column. *Pholidota* with pseudo-bulbs or fleshy jointed rhizomes; *Spathoglottis* a native of Malacca, China, India and the Philippines, with a few pretty species of yellow and crimson; *Phaius* with large and showy flowers, spread over tropical and subtropical Asia. *P. grandifolius* is found in Australia, and even New South Wales, as well as Malaysia. Generally speaking the EPIDENDREÆ are tropical American.

The tribe VANDEÆ are pretty equally divided between the tropics of America and of the old world, and very rare elsewhere. Amongst the most ornamental are *Eulophia* with a handsome crest in elevated ridges on the labellum, and *Vanda* (the Sanskrit name of the original species of this genus) with deliciously fragrant as well as beautiful flowers. There are about a dozen, if not more, Malaysian species in cultivation. *Renanthera* so-called from the

kidney shape of the pollen masses. *R. coccinea*, probably indigenous, but at any rate cultivated in Singapore (from Cochin China), is a splendid plant; the loose lateral panicles of flowers have the sepals of a pale blotched scarlet, and the petals and labellum a brilliant yellow and scarlet. *Saccolabium* is beautiful and interesting; some species will produce from 30 to 100 spikes of flowers every season. There are eight or ten highly ornamental kinds in Malaysia. *Sarcanthus* is equally prolific and quite as showy. *Œceoclades* has probably one or two fine plants undescribed in the Peninsula. *Angræcum* is an African genus the name of which is Angurek amongst the Malays. The species are very ornamental. *Acanthophippium* has pseudo-bulbs instead of tubers with rich flowers produced near the base of the shoots. One very fine crimson rose species is cultivated from Java. *Calanthe* the name of which (beautiful flowered) tells its character, has many species in Java, Japan and the Straits Settlements, all especially attractive. *Phalænopsis* (from *φάλαινα* a moth) so called from a fancied resemblance to a butterfly, is a beautiful plant, commonly called the Indian Butterfly Orchis. The flowers are large and either white or yellowish, produced on an erect spike; there are also pink and purple species, only a few of which have been described. Borneo is said to be especially rich in species.

The OPHREÆ are rare in the tropics, and also the tribe ARETHUSEÆ; though *Vanilla* is a genus which has been introduced and is sometimes seen in the jungle. The NEOTTEÆ grow principally in extra-tropical Asia and Australia, except one genus *Anœctochilus*, a terrestrial orchid with creeping slender jointed rhizomes and spikes of white or yellow blossoms and radical leaves. Some are traversed by glistening silver or golden veins on a rich green or purplish ground. An allied genus (*Physurus*) has its leaves similarly veined; the commonest species is *P. pictus*.

Cypripedium is a remarkably handsome genus, constantly met in cultivation. They are not confined to the tropics; but are particularly well represented in Malaysia.

The following is a list of the principal orchids which are worthy of attention in the Malaysian region.*

Dendrobium acerosum, flower yellowish and pink; Singapore. *D. aciculare*, yellowish; Singapore. *D. acuminatissimum*, greenish; Manila. *D. aduncum*, pink; Manila. *D. affine*, white and brown; Timor. *D. albo-sanguineum*, white and red; Malay Peninsula. *D. amboinense*, rose; Amboyna. *D. anosmum*, purple; Philippines. *D. auriferum*, yellow; China and Malay Peninsula. *D. calcaratum*, green; Singapore. *D. criniferum*, yellow; Ceylon. *D. crumenatum*, white; Sumatra. *D. cucumerinum*, colour ?; Malaysia. *D. violæ-odorum*, white; Java. *D. cumulatum*, pink; Java. *D. cymbidioides*, deep yellow; Java. *D. dayanum*, colour ?; Java. *D. discolor*, yellow and brown; Java. *D. erosum*, colour ?; Java. *D. excavatum*, colour ?; Java. *D. flavescens*, yellow; Java. *D. gemellum*, yellowish-green; Singapore. *D. glaucophyllum*, colour ?; Java. *D. glumaceum*, green; Philippines. *D. hasseltii*, purple; Java. *D. hymenophyllum*, colour ?; Java. *D. junceum*, green; Singapore. *D. kuhlii*, pale purple; Java. *D. longicolle*, streaked with purple;

* The discovery of a new species of *Cypripedium* in the Malay Peninsula deserves some mention here, as unquestionably the small group of Malaysian *Cypripedia* is the handsomest of the genus. The new species *C. sanderianum* is probably the most wonderful-looking flower in an order where wonderful structures are the rule. The leaves are long, broad, and of bright green colour, shining as if varnished. The flower stems are deep reddish-purple, with velvet covering, bearing from three to five flowers. The green bracts are purplish outside, striped with darker purple within and ciliate at the edges; sepals very concave, triangularly lanceolate, covered with stiff hairs and dark purple veins: petals linear like long dependent thongs *some 18 inches in length*, broader at the base, with transverse lines of rich red, mottled with pale cream colour. The thong-like portions are blackish purple with peculiar rounded, slightly swollen terminations. The long dependent curled and almost snake-like petals, as they are seen emerging from the half-open buds, are very singular and beautiful, and must be seen to be appreciated. The group of Malaysian *Cypripedia* includes only about nine species, namely—*C. platytænium*, *glanduliferum*, *philippinense* (or *lævigatum*), *haynaldianum*, *parishii*, *roebelenii*, *stonei* and *lowii*. All differ considerably from other *Cypripedia*, having their counterpart in the *Selenepedia* of S. America. *C. sanderianum* is a near ally of *C. roebelenii* and *C. philippinense*. (See "Reichenbachia," by F. Sander, Pt. I. May, 1886, p. 7).

Singapore. *D. lowii*, yellow; Borneo. *D. macranthum*, lilac; Luzon; Philippines. *D. macrochilum*, rose; Luzon. *D. macrophyllum*, purple; Philippines. *D. giganteum*, rose; Philippines. *D. miserum*, white; Philippines. *D. mutabile*, rose; Java. *D. nudum*, pale purple; Java. *D. pictum*, crimson; Borneo. *D. latifolium*, pale rose and yellow; Singapore, var. with green flowers at Manila. *D. planibulbe*, purple and white; Luzon. *D. plicatile*, yellow and red; Luzon. *D. revolutum*, straw-coloured; Singapore. *D. rhombeum*, pale yellow; Luzon. *D. rigidum*, colour ?; Java. *D. ruckeri*, yellow; Philippines. *D. rugosum*, pale yellow; Java. *D. salaccense*, yellow; Java. *D. scopa*, whitish; Philippines. *D. secundum*, rose purple; Malacca. *D. pallidum*, pale purple; Sumatra. *D. taurinum*, yellow and purple; Philippines. *D. teres*, white and orange; Singapore. *D. undulatum*, flowers in long spikes, yellow and brown; common amid mangroves, Malaysia to Australia. *D. vaginatum*, straw-coloured and purple; Singapore. *D. veitchianum*, yellow, white, and crimson; Java. *D. zollingerianum*, Java and Singapore; var. *album*, Singapore.

Dendrochilum abbreviatum, green and white; Java. *D. filiforme*, green and yellow; Luzon. *D. glumaceum*, pale green; Manila. *D. latifolium*, green; Manila. *D. longifolium*, greenish-white; Singapore.

Aporum indivisum, colour ?; Java. *A. leonis*, red-brown; Singapore. *A. sinuatum*, yellow; Singapore. *A. sarcostomum*, colour ?; Malacca.

Bolbophyllum adenopetalum, yellow; Singapore. *B. beccari*, white; Borneo. *B. calamarium*, yellow; Singapore. *B. limbatum*, purple; Singapore. *B. lobbii*, yellow-brown; Java. *B. pileatum*, yellow; Singapore. *B. purpureum*, purple; Java. *B.* sp., yellow; common in Malay Peninsula. *B. vaginatum*, brown; Singapore.

Cirrhopetalum antenniferum, brown; Philippines. *C. auratum*, yellow and crimson; Manila. *C. blumei*, yellow and red; Java. *C. candelabrum*, straw-coloured and purple; Manila. *C. capitatum*

yellow and orange; Java. *C. compressum,* purple and yellow; Java. *C. cumingii,* ruby-coloured; Philippines. *C. elongatum,* red and yellow; Java. *C. maxillare,* brown and yellow; Philippines. *C. medusæ,* pink spotted; Singapore; Borneo. *C. nutans,* pale straw-coloured; Manila. *C. pahudii,* colour? ; Java. *C. stramineum;* Sumatra. *C. thouarsii,* colour? ; Java. *C. vagi natum,* pale yellow; Singapore. Besides other undescribed species in cultivation.

Eria armeniaca, orange; Philippines. *E. bractescens,* stone colour; Singapore. *E. cochleata,* white and crimson; Luzon. *E. convalarioides,* white; Keddah. *E. denticulata,* white; Singapore. *E. dillwynii,* white; Philippines. *E. flava,* yellow; Java. *E. fusco-viride,* brown and green; Singapore. *E. leucostachys,* white; Borneo. *E. mucronata,* white and pink; Singapore. *E. multiflora,* white; Malacca. *E. nutans,* white and yellow; Singapore. *E. obesa,* white; Singapore. *E. ovata,* crimson and white; Singapore. *E. pannea,* green and yellow; Singapore. *E. polyura,* white; Manila. *E. stellata,* yellowish; Java. *E. velutina,* yellow; Singapore. *E. vestita,* red-brown; Malacca.

Cœlogyne:—Pseudo-bulbous Orchids with flowers large and membranaceous, pollen masses four in number, waxy, united by a granular substance; stigma deeply hollowed out, two-lipped. *C. asperata,* Lindley, India (= *C. lowii,* Paxton), white; Borneo. *C. cinnamonea,* brown; Java. *C. corrugata,* yellowish; Perak. *C. cumingii,* white, crimson, and yellow; Singapore. *C. longifolia,* colour? ; Mount Salak, Malacca. *C. pandurata,* green and black; Borneo. *C. plantaginea,* pale yellow; Singapore. *C. speciosa,* brown; Java. *C. testacea,* brown; Singapore. *C. trinervis,* white and yellow; Singapore.

Pholidota clypeata, green and yellow; Borneo. *P. conchoidea* yellow; Luzon. *P. imbricata,* yellowish; Malay Peninsula.

Spathoglottis aurea, yellow; Malacca. *S. plicata,* colour? ; Singapore. *S. tomentosa,* crimson; Mindanao, Philippines.

Cymbidium aloifolium, purple and yellow; Malaysia. *C. atropurpureum,* dark purple and yellow; Borneo. *C. brevilabre,* green,

red and yellow; Singapore. *C. pubescens,* purple and yellow; Singapore. *C. sanguineum,* red; Java.

Arundina densa, rose and violet; Singapore. *A. speciosa,* colour ?; Java.

Collabium nebulosum, dark purple and yellow; Java.

Plocoglottis acuminata, colour ?; Singapore. *P. javanica,* colour ?; Perak; Johore.

Phaius callosus, brown and white; Java. *P. grandifolius,* brown, red, white; Perak; Selangore.

Thrixspermum unguiculatum, rose pink; Luzon, Philippines. Plant like *Phalænopsis rosea;* flowers much inferior, often imposed upon purchasers for *Phalænopsis.*

Eulophia macrostachya, yellow and green; Singapore. *E. squalida* pale green; Manila.

Vanda batemanni, crimson and yellow; Moluccas. *V. fuscoviroides,* brown; Java. *V. gigantea,* white, Perak. *V. hookeri,* colour ?; Labuan, Borneo; Kinta, Perak. *V. helvola,* red; Java. *V. insignis,* lilac and brown; Java. *V. lamellosa,* pale yellow; Luzon. *V. limbata,* brown and lilac; Java. *V. lissochilus,* colour ?; Luzon. *V. suavis,* white and purple; Java. *V. tricolor,* yellow and rose; Java. *V. violacea,* white and violet; Luzon.

Renanthera arachnites, brown and purple; Java and Singapore. *R. lowii* (*Vanda,* Lindley) yellow and brown; Borneo. *R. matutina,* brownish; Java.

Saccolabium bifidum, pink and yellow; Luzon. *S. blumei,* violet and white; Malaysia and Philippines. *S. compressum,* crimson and white; Luzon. *S. densifolium,* rose; Manila. *S. harrisonii,* colour ?; Timor. *S. hendersonianum,* colour ?; Malaysia. *S. macrostachyum,* rose; Philippines. *S. miniatum,* vermilion; Java. *S. pallidum,* pink; Manila.

Bromheadia finlaysonianum, colour ?; Singapore. *B. palustris,* white; Singapore.

Sarcanthus croceus, yellow; Luzon. *S. teretifolius*, colour?; Singapore.

Œceoclades falcata, white; Malaysia.

Ærides huttoni, white; Borneo. This genus is named from *aer* the air, because the plants possess the power of living almost entirely upon matter which they absorb from the atmosphere. The flowers usually are very fragrant and amongst the largest orchids known. *Æ. tæniale*, growing on branches, has long flat roots hanging down like the joints of a tape-worm; hence the name. *Æ. quinquevulnerum*, pink, with five red blotches on each flower, which the Spaniards in the Philippines likened to the wounds of our Lord; it is cultivated in Singapore. *Æ suaveolens*, colour?; Java. *Æ. suavissimum*, white, lilac, orange; Malacca. *Æ. virens*, purple and white; Java. *Æ. superbum*, purple and white.

Thelasis capitata, Bl., colour?; Java. *T. carinata*, Bl., colour?; Java.

Acanthophippium javanicum, crimson, rose; Java.

Calanthe abbreviata, colour?; Java. *C. angustifolia*, colour?; Java; Gunong Hijau, Perak. *C. curculigoides*, orange; Malacca. *C. emarginata*, violet and orange; Java. *C. furcata*, white; Luzon. *C. parviflora*, colour?; Java. *C. pulchra*, orange; Java. *C. speciosa*, orange; Java. *C. veitchii*, purple and rose; Borneo. *C. veratrifolia*, white; Java. *C. vestita*, white and crimson; Perak; Malacca; Singapore; Borneo.

Grammatophyllum fastuosum, brown and yellow; Malacca. *G. multiflorum*, green and brown; Luzon. *G. scriptum*, colour?; Amboyna. *G. speciosum*, yellow and purple; plant ten feet high; flower-stem six feet long; flowers six inches across; called the Queen of Orchids; Java. *G. tigrinum*, brown-spotted; Luzon.

Leopardanthus scandens, colour?; Java; Singapore.

Phalænopsis amabilis, white and yellow; Manila; Borneo. *P. grandiflora*, white and yellow; Java; Borneo. *P. cornucervi*,

colour ?; Java and Malay Peninsula. *P. lowii*, pink and white; Malay Peninsula. *P. luddemanniana*, colour ?; Philippines. *P. rosea*, pink and white; Luzon. *P. schilleriana*, purple; Philippines. *P. sumatrana*, colour ?; Sumatra. *P. violacea*, violet; Kinta, Perak.

Goodyera procera, cinnamon; Singapore. *G. rubicunda*, cinnamon; Malaysia.

Anœctochilus dawsonianus, colour ?; Malacca. *A. lowii*, colour ?; Borneo. *A. setaceus;* Ceylon; Malaysia. *A. xanthophyllus;* Gunong Pulai, Johore. (All inconspicuous flowers).

Cypripedium barbatum, rose and brown; Malacca; Penang; Keddah. *C. conçolor*, yellowish; Perak. *C. hirtissimum*, purple and brown; Java. *C. hookeri*, purple and yellow; Java. *C. lawrencianum*, colour ?; Borneo. *C. lowii*, green, purple, and yellow; Borneo, *C. purpuratum*, purple; Hongkong. *C. stonei*, purple; Borneo.

Physurus sp.; Perak.

WATER PLANTS.—Reference has already been made to *Nelumbium speciosum*, and the lotus (*Nymphœa*) which are seen in all still waters. In other respects the ponds and running streams are infested with the usual water plants. Thus the aquatic dicotyledons principally belong to the HALORAGEÆ, with some representatives amongst the ONAGRARIEÆ, LENTIBULARIRIEÆ, &c. A common floating or creeping herb with alternate oval leaves and yellowish flowers is seen in all swamps and brooks. This is *Jussieua repens* common in most tropical countries including Australia, as far south even as Victoria and South Australia. There are curious floats of cellular tissue attached to the submerged nodes of the stems. The HALORAGEÆ are a nearly allied order including the Water-chestnuts (*Trapa*), important food-plants in north-west India and China, the Mill-foils (*Myriophyllum*), the Horn-worts (*Ceratophyllum*), and the Mare's-tail (*Hippuris*), with that universally diffused small smooth water-weed or star-wort

seen equally in the ditches of Britain, America, Australia and Malaysia. This is *Callitriche verna*, worth more than a passing examination for its curious fruits and monœcious flowers. It is doubtful whether *Myriophyllum* occurs in Malaysia; if it does, *M. indicum*, Willd., is the species. The *Trapa* can be recognised by the seeds, but the lower leaves are finely multifid like *Myriophyllum*, while the upper or floating ones are deltoid, smooth and disposed in a rosulate manner. The white kernel inside the hardened calyx-lobes tastes like a chestnut and is nourishing. It is largely used in France, Italy, India, Thibet, China and Japan. The Japanese use the roots also, though the taste is not agreeable. In *Hippuris* the flower is reduced to a calyx of the smallest size, no petals and but one stamen and one carpel. The stem is curiously formed of cellular tissue radiating from the centre with large air-cavities between. The centre is a cylinder of fine woody tubes, cellular tissue and spiral vessels, which led Prof. Link to regard them as endogens. The LENTIBULARIEÆ are represented by probably half-a-dozen species of *Utricularia*, the commonest of which are *U. stellaris*, *U. exoleta*, *U. bifida* and *U. reticulata*. In all these the stems are floating with the leaves submerged, divided into capillary segments with minute bladders attached, hence the vernacular name Bladder-worts. Several small Indian species, growing on the ground, are leafless at the time of flowering. *U. reticulata*, a species with large purple flowers, is common in rice-fields. It is variable in its habit and the size of its flowers. The larger forms of it are twining; the smaller rigid and erect.

Of endogenous water-plants there is of course the Duck-weed (*Lemna oligorrhiza*) a rather larger species than that of Europe. *Potamogeton tenuicaulis* with a few linear submerged leaves takes the place of the British *P. natans*. The Malaysian Frog-bit is *Enhalis kœnigii* with linear leaves and edible fruits found in fresh and brackish waters. Its fibres are capable of being woven.*

* On the authority of Lindley (Veg. King. p. 141), who quotes Agardh, Aphorismi Botanici, a reference which I am unable to verify. I know of no economical purpose to which the fibre is applied in the East, but I may add my own observation that the plant is rich in fibre of a fine and tenacious quality.

Pistia stratiotes is found in all the freshwater streams and lakes of Malaysia and the Philippines, covering the surface with plants that look like small lettuces. It floats in rafts bound together by runners, with roots hanging free in the water or touching the muddy bottom. It is very acrid, but in the Philippines is boiled and used as food for pigs. *Blyxa roxburghii* is a submerged herb with long, grass-like, acute and entire leaves, without laminæ, tufted, with the flowering peduncles at the bottom of the water. This is spread in the fresh waters of tropical Asia along with *Vallisneria spiralis* from which it differs in the shape of the leaf and flower. Another submerged herb, but with the radical leaves and peduncles in tufts together on the muddy bottom, and with the leaves bearing a broad lamina, is *Ottelia alismoides*, a species found in every stagnant pool throughout Malaysia and the East Indies. *Hydrilla verticillata* is also common and widely dispersed in still and running waters, not only in the tropics, but the temperate regions of Europe and Asia. The stems are leafy throughout, with short verticillate leaves; it is much branched and floats under the water in large masses, where it has proved fatal to many a swimmer. Finally *Monochoria vaginalis* is an aquatic herb common in the rice-fields and ditches, with radical, petiolate, cordate leaves, and racemes (apparently springing from the side of a petiole) of several rather large bright blue flowers. It is employed in Indian pharmacy in liver complaints and stomach diseases. Rubbed down in butter and eaten, it is thought to remove redness of the eyes; powdered and mixed with sugar it is administered in asthma; and when chewed is said to relieve toothache; brayed with milk it is given in fever; and finally, when young is eaten as a vegetable. It is very abundant in ditches around Thaiping, Perak. The other members of the pond-weed families including the Grass-wrack, the Eel-grass, Duck-weed, Water-plantain, Cat-tails, Arrow-heads and Flowering-rushes, have nothing special about them. *Azolla rubra* is a common minute aquatic cryptogam which completely covers the surface of the water with a purplish-green crust.

Crinum asiaticum, a bulbous plant with large mostly white flowers in a terminal umbel, is seen on the water-sides of most tropical streams, and by the sea-side in Asia, Africa and Australia. The same may be said of an equally showy plant closely resembling it, named *Eurycles amboinensis*. Both belong to the order AMARYLLIDEÆ.

Though the cryptogams will be dealt with subsequently, mention may here be made of an aquatic fern, *Ceratopteris thalictroides*, with distinct sterile and fertile fronds. The genus is limited to the single species which is widely distributed over the tropical regions of the whole world. The spores of this species are interesting to the microscopist as they are marked with curious concentric rings.

Ataccia cristata is a peculiar-looking plant in the jungle, of which a separate order, the TACCACEÆ, has been made. The flowers are arranged in umbels at the end of a scape of green and dark purple, with numerous long filaments of sterile pedicels. In the South Seas a kindred plant is cultivated for the starch of the root. The root is red, round, and about three inches in diameter, bitter and acrid, but losing some of this by culture. The raw root is peeled, rasped and washed frequently, when a starch is separated and again washed until the water has no longer an acrid taste. The bitter juice is probably violently poisonous. The meal makes a tasteful, nourishing, gelatinous bread, consisting principally of bassorin. The starch consists of circular or polyhedral particles with few and not very distinct rings. In Banda it is preferred to sago bread, and generally in the Moluccas is used for cakes and confectionery. The name *Tacca* is said to be derived from the Malay language, while Royle* says that it is the Tacca-youy of some navigators. The tubers are eaten in China, Cochin China and Travancore. The leaf-stalks and scape, as well as the roots, are boiled for a long time to destroy the acridity, but even then some vegetable acid is required to make it palatable.

* "Illustrations of the Botany of the Himalayan Mountains," p. 378.

The Malay plant is not the same as a Tacca similarly used in the Pacific Islands, of which Mr. Nuttal* has pointed out the differences. Ellis in his "Polynesian Researches"† says that the "*Pia* or Arrowroot, *Chailia Tacca*, grows on the high sandy banks near the sea or on the sides of the lower mountains." The starch is obtained by rasping with a board on which coarse coir twine is wound. The pulp is washed with *sea-water* and strained, the sediment formed into balls, dried in the sun for 12 or 24 hours, then broken and reduced to powder, which is left in the sun to dry. This detail is given as one of many points of contact, domestic as well as linguistic, between the Malay and Polynesian races.

Cryptogams.—In such a moist and warm climate, with dense shady forests, ferns, mosses, lichens and fungi must be abundant. Every rock and every foot of forest ground, the dead timber especially, and the roots and stems of the tall trees are, so to speak, muffled and enshrouded with this kind of vegetation. It is marvellous sometimes to see how deeply the ground is covered with this growth. To step aside off the narrow beaten tracks into the tangled thicket of branches and dead wood causes one frequently to disappear into as much as five, ten, and even fifteen feet of a mass of ferns, mosses, vines, rattans and decaying vegetation. Or when one attempts to peer through the almost vaulted roof of branches with which the forest glades are so thickly covered, one sees a rich and varied aerial growth which quite impedes any extensive view. Bird's-nest Ferns (*Asplenium nidus*) and Stag's-horn Ferns (*Platycerium biforme*) beautifully ornament the lofty branches of the stateliest trees, causing an astounding mass of vegetation to hang as it were in mid-air. The Bird's-nest Fern standing out like a feathered coronet, the Stag's-horn dependent as a graceful fringe, while the giant Polypody (*Polypodium heracleum*)

* "American Journal of Pharmacy," IX. p. 306.

† "Polynesian Researches during a residence of nearly eight years in the Society and Sandwich Islands." By the Rev. William Ellis, I., p. 361 (4 vols. 12mo. London, 1839).

sends stout and tall fronds eight and ten feet into the air. The large species moreover of tree-ferns, and such giants as *Angiopteris evecta*, vie with the Palm-trees in the spread of their graceful fronds, while the epiphytes of the smaller kind make hoary tufts and clothing for almost every tree. The little *Drymoglossum piloselloides* is seen on every tree, outside the forest as well as in it, and many other minute forms, particularly *Polypodium*, *Niphobolus* and *Vittaria.*

I do not propose to enter into any detail about the genera and species which is obviously beyond the scope of this essay, but I give a list from the "Journal of Botany"* of the ferns found in Perak by Father Scortechini and myself and described by Colonel Beddome, which I may say includes nearly all that is known up to the present time of the cryptogamic flora.†

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* Journ. of Botany, Nov. 1887, XXV. p. 321, pl. 278.

† I take this opportunity of explaining a circumstance under which the ferns described by Colonel Beddome were collected. I arrived in Perak in November, 1883, having previously travelled through Java, part of Sumatra and much of the Malay Peninsula. In all these journeys I had made extensive collections of plants, some of which I exchanged with Mr. Nicholas Cantley, the Government Botanist, Singapore. Father Scortechini arrived in Perak on March 1st, 1884, and we explored and collected together for about six months, under the auspices of the Perak Government and at its expense. The Rev. Mr. Scortechini devoted himself exclusively to botany, and so on his arrival I handed over to him all my collections of plants from the Straits Settlements and elsewhere, with the understanding that I was to get a complete set of the ferns from his collections before he went to Kew. The melancholy and unexpected death of the rev. gentleman at Calcutta prevented this arrangement being carried out, and I mention it only for the purpose of stating that I am the authority for many of the habitats given in the ensuing list. They may have been found subsequently in other places by Father Scortechini, but I give the habitats that I know. Perhaps it may be permitted to me here to add the inestimable loss science has sustained by the premature death of so learned, painstaking, and experienced a botanist. Personally amiable, generous, and self-sacrificing, he was an invaluable companion to me in my explorations. He was indeed an instance of the *ἄνθρωπον παντα καλῶς ποιεῖν*, whose loss was equally great to friendship and to fame.

A LIST OF THE FERNS OF THE MALAY PENINSULA.

The species marked * have not been previously recorded from the Peninsula.

Gleichenia dicarpa, Br., var. *vulcanica*, Bl., on all the roadsides and throughout the jungles of the Malay Peninsula and Indian Archipelago. **G. flagellaris*, Spr., very common on roadsides near Singapore. *G. norrisii*, Mett., Salama River, Perak, near Malacca. *G. dichotoma*, Willd., very wide-spread and common, extending to Australia.

Cyathea brunonis, Wall., mountain ranges to 3,000 feet.

**Alsophila obscura*, Scort., not common, but I believe this species was found in the interior beyond the Kinta River, Perak; *A. glabra*, Hook., Maxwell's Hill, Perak; *A. latebrosa*, Hook., all through the Peninsula occasionally; *A. latebrosa*, var. with very broad segments, Arang Para ?; *A. glauca*, J. Sm., in the gullies on the lower slopes of Gunong Bubu; *A. kingi*, Clarke; *A. commutata*, Mett.; **A. trichodesma*, Scort., this specimen was, I believe, found on the Upper Salama River, on the Keddah side of the shore; its nearest ally is *A. andersoni*, Scott, Sikkim.

Matonia pectinata, Br. This plant is stated by Wallace to be found only on the summit of Mount Ophir, which he also believed to be the highest mountain in the Malay Peninsula, this being the general impression at the time of his visit (1861. See Wallace, "Malay Peninsula," p. 31). Found also on the upper slopes of Gunong Bubu when first explored, and then generally at a height of about 4,000 feet throughout the Peninsula. It occurs also in Java.

**Dicksonia barometz*, Link., in the deepest mountain gullies hroughout Perak; *D. (Dennstœdtia) ampla*, Baker.

Lecanopteris carnosa, Bl.

Hymenophyllum polyanthos, Sw., var. *blumeanum*, Spr., Arang Para on stems of tree-ferns; *H. javanicum*, Spr., var. *badium*, Hooker and Greville; *H. javanicum*, Spr.; *H. smithii*, Hook.; *H. neesii*, Hook.; **H. aculeatum*, V. d. B.

* *Trichomanes neilgheriense*, Bedd., not uncommon in northern Perak; *T. parvulum*, Poir., this wide-spread species is common everywhere; *T. pyxidiferum*, another very common species widely spread over all tropical regions; *T. digitatum*, Sw.; *T. pallidum*, Bl.; *T. bipunctatum*, Poir.; *T. auriculatum*, Bl.; *T. javanicum*, Bl.; *T. rigidum*, Sw., very common and widely spread; *T. maximum*, Bl.; *T. pluma*, Hk., on the summit of Gunong Bubu above 5,000 feet.

Davallia (Humata) heterophylla, Sm.; *D. angustata*, Wall.; *D. pedata*, Wall., common in Perak and widely spread; *D. (Prosaptia) emersoni*, Pres.; *D. contigua*, Sw.; *D. (Leucostegia) pulchra*, Dru.; *D. hymenophylloides*, Bl.; *D. nodosa*, Presl.; *D. solida*, Sw.; *D. elegans*, Sw.; *D. epiphylla*, Bl.; *D. divaricata*, Bl.; *D. griffithiana*, Hk.; *D. bullata*, Wall.; *D. (Microlepia) pinnata*, Cav.; **D. moluccana*, Bl.; *D. speluncæ*, Baker, very common and widely spread; *D. (Stenoloma) tenuifolia*, Sw.

Lindsaya cultrata, Sw.; *L. repens*, Thw., the jungle, Arang Para; *L. scandens*, Hk.; *L. orbiculata*, Lam.; **L. borneensis*, Hk.; *L. lancea*, L.; *L. rigida*, J. Sm.; *L. divergens*, Wall.; *L. lanuginosa*, Wall.; *L. lobata*, Poir.

Pteris longifolia, L., on rocks and trees everywhere in the jungle, Malay Peninsula; *P. cretica*, L., equally common with preceding, on buildings, rocks, &c., Malaysia generally; *P. semipinnata*, L.; *P. patens*, Hook.; *P. quadriaurita*, Wall., the white variegated variety, jungle, Perak River; Kuala Kangsa: *P. aquilina*, L., waste sterile savannahs, Malaysia generally; *P. aquilina*, var. *esculenta*, Forst., waste sterile savannahs as above; *P. (Doryopteris) ludens*, Wall.; *P. (Litobrochia) incisa*, Thunb., Maxwell's Hill, Thaiping, Perak, about 3,000 feet; *P. marginata*, Bory.

Ceratopteris thalictroides, Brong., Salama River, Perak River, and common in all Malayan streams.

Lomaria (Plagiogyria) pycnophylla, Kze., Arang Para on lower slopes.

Blechnum orientale, L., common in all Malayan jungles; *B. findlaysonianum*, Wall.

Asplenium (Thamnopteris) nidus. L., on trees in all Malayan forests;* *A. scortechinii*, Bedd., Caulfield's Hill, Maxwell's Hill, above 3000 feet. The following *Asplenia* are generally diffused through the mountain ranges:—*A. amboinense*, Willd.; **A. squamulatum*, Bl.; *A. normale*, Don; *A. subavenium*, Hk.; *A. longissimum*, Bl.; *A. tenerum*, Forst.; **A. borneense*, Hook.; *A. hirtum*, Kaulf.; *A. falcatum*, Lam.; *A. macrophyllum*, Sw.; *A. caudatum*, Forst.; *A. cuneatum*, Lam.; *A. nitidum*, Sw.; *A. belangeri*, Kze.; *A. (Anisogonium) cordifolium*, Mett.; *A. lineolatum*, Mett.; *A. esculentum*, Presl.

Diplazium subserratum, Bl.; *D. porrectum*, Wall.; *D. pallidum*, Bl., *D. bantamense*, Bl.; *D. sylvaticum*, Presl.; *D. tomentosum*, Hk.; *D. speciosum*, Mett.; *D. sorzogonense*, Presl.; *D. asperum*, Bl.; *D. polypodioides*, Mett.

Didymochlæna lunulata, Desv., in all the jungles on the mountain sides up to 3,000 feet; *D. polycarpa*, Baker.

Aspidium (Polystichum) auriculatum, L., var. *marginatum*, Wall.; do. var. *cæspitosum*. Wall.; *A. aculeatum*, Sw., var. *biaristatum*, Bl., occasionally met with in the undergrowth in all Malaysia; *A. (Pleocnemia) leuzeanum*, Hook.; *A. membranaceum*, Hook.; *A. singaporianum*, Wall., occasionally met with through the whole Peninsula; *A. melanocaulon*, Bl., fragment only; *A. vastum*, Bl.; *A. subtriphyllum*, Wall.; **A. pachyphyllum*, Kze.; *A. variolosum*, Wall.; *A. cicutarium*, Sw.?

Nephrodium (Lastrea) gracilescens, Bl.; *do. var. *glanduligera*, Kze.; *N. calcaratum*, Bl., var. *sericea*, J. Sm.; *N. crassifolium*,

Bl.; do. var. *mottleyanum*, Hk.; *N. syrmaticum*, Hk.; **N. dayi*, Bedd.; *N. filix-mas*, Rich., var. *elongata*, Hook.; *N. sparsa*, Don; *N. blumei*, Hook.; *N. boryanum*, Baker; *N. unitum*, L.; **N. eminens*, Baker; *N. pennigerum*, Bl., var.; *N. molle*, Desv., extremely common everywhere in Malaysia; *N. crinipes*, Hk.

**Nephrolepis exaltata*, L.; *N. volubilis*, J. Sm.; *N. biserrata*, Schott; **N. acuminata*, Hout.

Oleandra neriiformis, Cav.; *O. musæfolia*, Kze.

Polypodium (Phegopteris) punctatum, Thunb.; **P. laserpitiifolium*, Scort.; *P. (Dictyopteris) difforme*, Bl.; *P. subevenosum*, Baker; **P. hirtellum*, Bl.; **P. cornigerum*, Baker; *P. cucullatum*, Nees; **P. triangulare*, Scort., on the very highest summits of the mountain ranges about Thaiping, where it grows in tufts on withered branches of stunted trees; *P. khasyanum*, Hook.; *P. fuscatum*, Bl.; *P. decorum*, Brack.; *P. obliquatum*, Bl.; *P. subfalcatum*, Bl.; **P. papillosum*, Bl.; **P. tenuisectum*, Bl.

Goniophlebium subauriculatum, Bl.; *G. verrucosum*, Wall.; **G. korthalsii*, Mett.

Niphobolus adnascens, Sw.; *N. acrostichoides*, Forst.; *N. stigmosum*, Sw.; *N. nummularifolium*, Mett.; *N. fissum*, Bl.; *N. penangianum*, Hk.

Pleopeltis accedens, Bl.; *P. wrayi*, Baker; *P. stenophyllum*, Bl.; *P. longifolium*, Mett., on rocks 3,000 feet; *P. angustatum*, Sw.; *P. superficiale*, Bl.; do. var.; *P. sinuosum*, Wall.; **P. rupestre*, Bl.; **P. platyphyllum*, Sw.; *P. irioides*, Lam., near mangrove swamps in all Malaysia; *P. musæfolium*, Bl.; *P.* sp. near *membranaceum*, but with the rachis shining black; *P. hastatum*, Thunb.; *P. incurvatum*, Bl.; *P. phymatodes*, L., near sea coast, Malaysia; *P. nigrescens*, Bl.; *P. longissimum*, Bl.; *P. palmatum*, Bl.

Dipteris horsfieldii, R. Br., generally above 3,000 feet, but at Singapore extending to sea-level; *D. bifurcatum*, Baker.

**Drynaria heracleum*, Kze., above 3,000 feet, Maxwell's Hill, Perak; *D. linnæi*, Bory; *D. rigidulum*, Sw.

**Monogramme paradoxa*, Fée.

Gymnogramme (Stegnogramme) aspidioides, Hk., var.; *G. fraxinea*, Don; *G. wallichii*, Hk.; *G. alismæfolia*, Hk.; *G. lanceolata*, Hk.; *G. involuta*, Hook; *G. feei*, Hk.; **G. hamiltoniana*, Hk.

Meniscium triphyllum, Sw.; *M. salicifolium*, Wall.; *M. cuspidatum*, Bl.

Antrophyum nanum, Fée; *A. reticulatum*, Kaulf., Maxwell's Hill, on granite rocks below bungalow, rare; *A. semicostatum*, Bl.; *A. latifolium*, Bl.

Vittaria elongata, Sw., Maxwell's Hill, on dead logs above bungalow; *V. falcata*, Kze., open forests at all elevations, on trees; **V. sulcata*, Kuhn, as above, but not common; *V. lineata*, Sw., throughout Malaysia; *V. scolopendrina*, Presl., as above.

Tænitis blechnoides, Sw., Arang Para.

Drymoglossum piloselloides, Presl., everywhere in Malaysia. A small epiphyte on the stems of trees; leaves of two forms; the sterile, elliptical; the fertile, contracted, linear.

Acrostichum (Elaphoglossum) conforme, Sw.; *A. (Stenochlæna) palustre*, L.; *A. sorbifolium*, L.; *A. (Polybotrya) appendiculatum*, Willd.; *A. (Gymnopteris) minus*, Mett.; *A. spicatum*, L.; *A. contaminans*, Wall.; *A. variabile*, Hk.; *A. subrepandum*, Hook.; *A. aureum*, L., in all mangrove swamps, where its fronds attain 10 to 12 feet; the young leaves are subject to great variation in colour, being often of a brilliant red, the older leaves coriaceous and shining green, contrasting well with the rich brown sori of the back: *A. (Photinopteris) rigidum*, Wall., common everywhere on the lower grounds; *A. drynarioides*, Hook., as above.

Platycerium biforme, Bl.; on trees at lower levels.

Schizœa malaccana, Baker; *S. dichotoma*, Sw., this fern sometimes takes the place of grass on savannahs, Perak; **S. digitata*, Sw.

Lygodium dichotomum, Sw., widely spread in all jungles; *L. flexuosum*, Sw., particularly abundant in open marshy plains about Thaiping, Perak; *L. microphyllum*, Br., as above and Singapore.

Angiopteris evecta, Hoffm., not very common.

**Kaulfussia æsculifolia*, Bl. I have seen this only in one place, on rocks, Maxwell's Hill, above 2,000 feet.

Ophioglossum reticulatum, L., moist, shady jungles near Kuala Kangsa; *O. pendulum*, L., as above.

Helminthostachys zeylanica, Hk., on the sea coast.

Cultivated Plants.—The cultivated plants in every country include many which do not belong to the indigenous flora; in fact, when we trace the origin of most of the useful fruits, flowers, and other vegetable products, it is astonishing how widely diverse are the sources from which they come. There is not an extensive list in Malaysia in comparison with other countries. Nevertheless it is of sufficient length to render necessary some condensation in this essay. For convenience I shall consider—(1) the fruits; (2) vegetables; (3) plants useful in manufactures, with some remarks on the ornamental trees and shrubs.

Fruits—In Malay Buah.—Several common tropical fruits need not be more than named here, such as the Sweet Sop, Sour Sop, Bullock's Heart, and Custard Apple, which are, though the fact has been disputed, undoubtedly of American origin. The local names, besides Cherimolia or Chirimoya, are applied so as to cause confusion; but generally the Sweet Sop and Sugar Apple is applied to *Anona squamosa*, L.; Sour Sop, *A. muricata*, L.; Bullock's Heart, *A. reticulata*, L.; and Chirimoya, *A. cherimolia*, Lam. The first two are not much cultivated, though the Sour Sop is used for ices, for which it is much esteemed, particularly

in Java. The Custard Apple is called Seri kaya. Bullock's Heart is well cultivated in the gardens round Malacca, and there it is obtained at its best. In Java it is a very poor worthless fruit.

Oranges and Lemons, that is, all the different varieties of Citrons, Lemons, Oranges, Shaddocks, &c., are well represented in the Malay Peninsula, though the climate is not favourable to the majority of the species. China is generally regarded as the indigenous home of the orange tribe, for which the Malay language has, however, many names, probably indicating an ancient cultivation. The following are quoted :—Limau-manis, L. kusturi, L. jamboa, L. japun, L. nipis, L. susu, L. asam (lemon, lime), L. jeruk (citron), Malay, Sundanese, and Javanese. In Borneo, in the wild countries of the Dusuns, near Gaya, I obtained very good oranges and lemons. Probably the orange most consumed in Malaysia is the Shaddock, or Pompelmouse (French), Linau gadang in Malay, *Citrus decumana*, Willd., the Poor Man's Orange of Europeans, or Pomeloe (from the Dutch Pompelmoes). It is said that the best of these come from Amoy in China; but they are equalled, if not surpassed, by those produced in Labuan, Borneo. For this the colony owes a debt to Sir Hugh Low, who was for over 20 years a resident on that island. During this time he gave unceasing care to the introduction and cultivation of tropical fruits. His garden and indeed every cultivated plot in the island give evidence of his skill and care. The large extent of the gardens round Government House might be likened to those of the Hesperides in the season of this magnificent fruit. It is of the richest kind and with a flavour of the finest quality. The original country of the fruit is not known, but the number of varieties in Malaysia indicates an ancient cultivation.

Roxburgh says, "that the species was brought to Calcutta from Java" (Roxburgh, "Flora Indica," edit. 1832, III., p. 393), and Rumphius ("Hortus amboinensis," II. p. 98) believed it to be a native of southern China. Neither he nor modern botanists saw it wild in the Malay Archipelago (Miquel, "Flora Indo-Batava,"

I. pt. 2, p. 526). In China the species has a simple name, *Yu*; but its written character (Bretschneider, "Study and Value," etc.), appears too complicated for a truly indigenous plant. According to Loureiro the tree is common in China and Cochin-China, but this does not imply that it is wild (Loureiro, "Fl. Cochin," II. p. 572). For another species of the genus he says that it is cultivated and non-cultivated (p. 569). "It is in the islands to the east of the Malay Archipelago that the clearest indications of a wild existence are found" (De Candolle, "Origin of Cultivated Plants," p. 178).

The rind of this species is much esteemed for bitters. It is said that Shaddock was the name of the captain who introduced the fruit to the West Indies. Pimpelnose is another name in English, and Pompoleon one in French. Some Malays for an unknown reason call this the Bali Lemon (Jeruk Bali, also Majang). In Javanese it is Limau kasumba. Other Malay names are Jeruk dalima, J. jamblang, J. gedogan. In Tagalo (Philippines), Dalandan, Dayap, and Kalamondin; Kahil, Visayan, besides Limon generally. Lemon susu is *Citrus medica*, L., probably indigenous to the Malay Peninsula, or at any rate introduced in ancient times into Java, Amboyna, and the Peninsula.* The orange in all Malaysia is much inferior to the varieties cultivated in southern Europe; not the only instance of naturalised fruits becoming much superior to the best productions in their native country.

* In Filet's "Plantkundig Woordenboek voor Nederl. Indie," and in Bisschop Grevelink's "Planten van Nederl. Indie, bruckbaar voor handel, nijverheid en geneeskunde" (Amsterdam 1883), a great number of Malay terms are given for different species of AURANTIACEÆ; but the references are too lengthy for quotation here. Filet gives a list of 35 names, but some of them are Sundanese and Javanese. The Dutch orthography makes them appear as if differing more from the common Malay terms than they are in pronunciation. Thus, jeruk, which according to these authorities is the common Malay term for these fruits generally, is spelled djeroek or djeroh, for the final *k* in Java is not sounded as in Perak Malay. The Philippine list of names might be much extended. The name jeruk is found in all the languages west of Celebes, as well as the Portuguese word limau.

The other members of the orange family in Malaysia deserving of some notice are, first, *Murraya exotica*, L. (Malay, Kamuning japan), which is found all over south Asia, Java, Timor, and the Moluccas; valued for its white fragrant flowers and small succulent fruits. The tree, however, and another species, *M. sumatrana*, Roxb., are valued on account of the wood, though seldom growing high, and the stems rarely exceeding a diameter of eight inches. The wood is pale yellow, grained with black, in quality much resembling box, and even finer, with a closer fibre, excellent for turners' work. The best grows in Menado, Celebes. Malays attach great value to this wood to make scabbards and ornamental boxes.

Cookia punctata is another member of the orange family, the fruit of which is much esteemed. It is a small orange, growing in bunches, extensively used in preserves by the Chinese, who call it Wampee. It is the Wilde-lansen of Valentyn, and Kibecha puti of the Malays, or Ki-bejek-bodas of the Sundanese.

Feronia elephantum, Corr., the Elephant Tree of India has a fruit about the size of an apple, when ripe green outside and yellow within, one-celled, with numerous seeds immersed in a fleshy edible pulp contained in a hard rough woody rind. The pulp is valued for preserves, besides being esteemed for its medicinal qualities. Altogether the tree is very useful. Lac is obtained from it, and it yields a gum like Gum Arabic. The yellowish wood, though rather coarsely fibrous and said not to be durable, is heavy, close-grained and hard, and takes a fine polish. The leaves smell like anise. From the unripe fruit a sour liquor named Kujak is made, used as a sambal with curries.

The Bael-fruit or *Ægle marmelos*, Corr., (Maja Malay, Mojo Javanese, the Slijm-appel-boom of the Dutch) has a world-wide reputation as a remedy for dysentery and diarrhœa. It is a tree from 30 to 40 feet high, much cultivated on account of the many medicinal qualities attributed to the fruit. It is thorny and leaf-shedding, with thick, greyish, smooth bark, and rather large, white, poor flowers; fruit woody, varied in shape, smooth, with

10-15 cells each containing 6-10 oblong woolly seeds embedded in a tenacious shiny yellowish pulp, very agreeable in flavour and fragrant. It is supposed to be indigenous in India, on the slopes of the Himalayas up to 3,500 feet. The wild fruit is said to be small, hard and devoid of fragrance. It is the unripe or half ripe fruit which is the efficacious remedy in dysentery and all cases of irritation of the mucous membrane of the stomach and bowels. It may be useful to give the prescription. "The unripe fruit is cut into small slices and dried, and in this state is used in the form of decoction, prepared with two ounces of the dried fruit and a pint of water. The mixture is to be gently simmered down to one-fourth, and of this the dose must depend on the attendant circumstances of the case. In bad cases of diarrhœa and dysentery three tablespoonsful are to be taken every two or three hours ; in milder cases the like quantity three or four times a day ; and in mild cases of irritation two or three times a day will be sufficient." (Pereira, "Materia Medica." Vol. II., pt. 2, p. 549.) Sir W. Jones observes of it that "it is nutritious, warm, cathartic; in taste delicious, in fragrance exquisite; its aperient and detersive quality, and its efficacy in removing habitual costiveness, have been proved by constant experience."* A sort of sherbet is prepared from it with tamarind juice, beneficial in fevers and inflammatory affections attended with thirst. A jelly and a preserve are made of the ripe fruit with sugar, and are used in cases of habitual costiveness and irritation of the stomach. The glutinous mucus surrounding the seeds is used by painters as a size and varnish, and, according to Royle, is an excellent addition to mortar, especially in well-digging.

Triphasia trifoliata DC., (Javanese Jeroh kingkit) a low-sized tree with small oblong red fruits and very fragrant flowers ; said to be wild in various places in Malaysia, but is far better known as an ornamental shrub in the gardens about Penang.

The Durian so widely known and so much the subject of animadversion from Europeans on account of its odour, may be

* Quoted by Ainslie in his "Materia Indicæ," II. p. 189.

called *the* fruit of Malaysia. It is said that all attempts to cultivate it in India or tropical America have failed. It is most abundant in Java, Sumatra, the Peninsula and Siam, where it is mostly in cultivation, though said to occur in a wild state; extending to the Sulu Archipelago, but not further into the Philippines (though Crawfurd says the contrary). It is rather curious to trace the different opinions about the offensive odour which, like all the Sterculiads, is emitted from the rind of the fruit. Rumphius and Valentyn state that in their time it was forbidden by law in the Moluccas to throw them near any public path. In the "Histoire des Voyages," copied by Lamarck in his Encyclopædia, it is said that the Durian diffuses an excellent odour, but the taste is rather unpleasant being that of fried onions. It is needless to state that the Malays are passionately fond of it, and most Europeans also, after a time. There are at least three varieties, in one of which the aril surrounding the nut is hard and leathery. There is, however, a great difference in the flavour in the same varieties, some being luscious and agreeable, while others are harsh and almost acrid with a large admixture of the odour with the flavour. Only a Malay knows how to choose a good Durian. A preserve or comfiture is made from the pulp which I have tasted but once, and then the flavour of garlic seemed disagreeably predominant.

The Amygdalaceæ and Rosaceæ do not flourish in Malaysia. European fruits cannot be successfully cultivated; but in Java, on the higher slopes and rich volcanic soils of the mountains almost everything can be produced. Thus very good Peaches, Almonds, Cherries, Cherry-laurels and Plums, with Strawberries and Raspberries, have rewarded the toil of the acclimatisers at Pantaran, Buitenzorg, and perhaps the Tengger mountain. The careful Dutch husbandry at Buitenzorg, with the advantages possessed by the Acclimatisation Society's garden, must soon place Java in possession of the fruits and flowers of every country of the world, whether tropical or temperate.

The Myrtaceæ produce perhaps a larger number of indigenous and introduced fruits in Malaysia than any other order, the

principal of which only can be enumerated. *Bæckia frutescens*, L. (Ujang atap and U. ratab, Malay) extends from Hong Kong and south China over the Philippines and Malaysia. It is a glabrous, heath-like shrub, with twiggy branches, minute linear subulate leaves, and small axillary solitary flowers. The Malays use this plant for many purposes, but more medicinally than as an esculent. It is considered an insecticide. "*Castae Battanae virgines tanquam medicamento abortivo utuntur*" (Junghuhn).

The *Eugeniæ* or Rose-apples, four in number (*Jambosa domestica*, Rumph., *J. alba*, Rumph., *J. aquæa*, Rumph., and *J. vulgaris*, DC., named respectively by the Malays Jambu-bol, J. puti or merah and J. ayer-mawer), are fruits well known throughout Malaysia, but little esteemed, for they have scarcely any flavour or juice: the flowers, however, are handsome. Forty-three species are enumerated by Filet, so it is one of the best represented genera in the region. *Syzygium jambolanum* or Juat of Sunda, and Buah-jamblang, Malay; Malaruat, Tagalo; Lumboi, Tagalo and Visayan, is another small tasteless fruit much resembling an olive in appearance. It grows extensively in the western groups of the Philippines, and is the only food of the natives when excessive rains and storms drive them to the mountains. Twenty other species are enumerated by Filet. Three species of *Pimenta* or Allspices (*Pimenta vulgaris*, Lind., *P. officinalis*, Lind., and *P. acris*, Wight) may be mentioned. Though occupying a doubtful position as fruits, they are valuable cultivated plants in all Malaysia. The Guava (*Psidium guayava*, L., Jambu biji or utan, Malay) is too well known to require particularising. It must have been introduced from South America into Malaysia very soon after the entry of Europeans into these countries, for it has become perfectly naturalised. Three species or varieties are enumerated by Rumphius, and therefore are of ancient cultivation. *Rhodomyrtus tomentosa*, DC. (Harendong, Malay) is abundant and widely spread over southern India, Ceylon, Malaysia and northwards to China and Japan; but probably in the latter an escape from cultivation. The berries are eaten and much used as a preserve, having an agreeable flavour. It has already been referred to for the beauty

of its flowers. *Soneratia acida*, L., previously described as the "Willow-tree" of Malaysian rivers, bears a sour fruit used in making curries and chutnee, and called Brambang by the Malays. *Punica granatum*, L., or the Pomegranate (Dalima, the red-flowered D. berrem with double flowers, D. susu with white flowers) will conclude this enumeration of Myrtle fruits.

Terminalia catappa, L., a large tree called by the Malays Katapang, is found on the sea-coast in all Malaysia. It is named by Europeans the Indian Almond, but the utterly insignificant kernel certainly renders it unworthy of the name of a fruit; nevertheless it is extensively cultivated for the shade given by its large leaves, and its ornamental character. *Grewia oppositifolia* yields an edible berry hardly worthy of mention, and several other species of different orders having small fruits consumed by the natives are omitted.

Zizyphus jujuba, Lamarck, is cultivated everywhere. The fruit is sometimes like an unripe cherry, sometimes like an olive. Burmah and British India seem to be its original abode. The Malays call it Bidara, but in Java the name is Doroh. Latterly another, quite a different tree, is sometimes called the Jujube. This is *Muntingia calabura*, L., a tiliaceous tree from tropical America recently introduced into Malaysia, and already abundant about Manila.

Morus indica, L., (Malay, Babesarem), the Indian Mulberry, is cultivated in Java, Celebes, and Amboyna for the sake of its fruit; and for silkworms in Java, in the Lampongs and Bencoolen.

Four species of the Cactus order, viz., *Opuntia cochinillifera*, Mill.; *O. polyantha*, Haw.; *O. tomentosa*, S. Dyck; and *O. dillenii*, Haw., have been introduced into Java for the sake of cochineal culture, and bid fair to become naturalised. Strange to say the Malays of Java call this fruit Juli badak or the Rhinoceros' Ear. The fruits are eaten.

Water-Melons and Rock-Melons in many varieties are of course found in cultivation throughout Malaysia. The Malays

call them Batteka, Mandiki, and Semangka. The Musk Melon is distinguished as Semangka belanda. Though long thought to be indigenous to southern Asia, the fruit is now generally admitted to be of African origin. *Cucumis trigonus*, Roxb., is a common wild species in Asia, extending to Australia. The only absolute difference between it and the wild Melon is that the former has a perennial root, while the Melon is strictly an annual. Most probably all the species are only forms of *C. melo*, and therefore the exclusively African origin of the plant cannot be maintained; for if the Asiatic species may have been an ancient escape from cultivation, this cannot be the case with the Australian ones, which have been found wild in the interior by the first explorers, from New South Wales right round to north-western Australia.

Carica papaya, the Papaw tree or Kattesh of the Malays, is found in the whole of Malaysia. The Gulf of Mexico or the West Indies is supposed to be the original habitat; but it is so widely spread in Malaysia that it must have been in cultivation shortly after the advent of Europeans to these regions. The property attributed to the milky juice of rendering meat tender has been much exaggerated, though probably having some foundation in fact. The fruits in Malaysia are small; they are cooked unripe as a vegetable (the seeds being removed), or eaten as a fruit when ripe. The seeds resemble in flavour *Tropæolum majus*, commonly called Nasturtium, a name properly belonging to the Water-Cress.

Of PASSIFLORACEÆ, whose fruit is eaten, the most important are *Passiflora filamentosa*, *pallida*, *lutea*, *coccinea*, *maliformis*, *quadrangularis*, *laurifolia*, *edulis*, *incarnata*, and *serrata*; *Tacsonia mollissima*, *tripartita* and *speciosa*; and the Madagascar shrub called *Paropsia edulis* (Lindley). None of these can be said to be much, if at all, in cultivation in Malaysia.

Inocarpus edulis (Gajam, Malay) is found in the Moluccas producing a nut which is cooked and eaten in Java. It is found in a few places in cultivation. *Persea gratissima*, Gaertn., or the

Avocado pear, is a tree of the Laurel family with the highest reputation for medicinal properties, and a husk rich in green oil. It is a native of the West Indies and is only cultivated in Java.

Bread-fruits, Jack-fruits, Champada and Terap or Tarippe, known to botanists as *Artocarpus incisa*, L., *A. blumei*, Tr., *A. elastica*, Reinw., and *A. integrifolia*, L., and to the Malays as Klowei, Sukon and Bendo in Javanese, are cultivated in all Malaysia, and from Sumatra to the Marquesas Islands; and this was the case when Europeans first visited these regions. De Candolle regards Bread-fruit as a native of Java and the Moluccas. Its fruit is constituted like the Pine-apple into a spherical fleshy mass, and, like that fruit, the seeds come to nothing. From this he argues, in the extreme eastern islands at least, the great antiquity of its cultivation and probably also its introduction. But, he adds, the number of varieties and facility of propagation by buds and suckers prevent our knowing its history accurately. The large almost palmate-leaved Bread-fruits are very ornamental. The Jack-fruit, called also Nangka, is more generally cultivated, producing immense fruits along the main branches or stem of the tree A species with smaller fruits which are much better flavoured is the Champada, distinguished by the underside of the leaves being hairy. It is a kind much preferred by the Malays. Finally, the Tarippe or Terap (*Artocarpus elastica*) is a round tree with leaves larger than the preceding, and hairy on both surfaces. The fruits are borne near the end of the branches, and not from the main branches or stem, as in Jack-fruit and Champada. Most persons prefer the Terap as being less tough and leathery and more juicy. The seeds of all the species are roasted like chestnuts and eaten. All yield a kind of gutta.

"The Tampoe or Tampui *(Pierardia dulcis ?)* is another very common jungle-fruit, of which but little appears to be known. There are three varieties—Tampoe shelou, Tampoe puti, and Tampoe baraja. The two first-named differ in one having yellow pulp and the other white. The last is a smaller fruit having four internal divisions instead of six, and the pulp is of a bright

chestnut colour. The part eaten is the pulp surrounding the seeds, which is agreeably sub-acid and very refreshing. The pavia-like husks and the seeds are discarded. The tree is 50 or 60 feet high, with dark green poplar-like leaves, and the fruits hang two or three together in lax clusters, the stalks being produced from the older branches. This fruit is eaten in large quantities by the natives; and the pulp, mixed with rice and water and afterwards fermented, affords them an intoxicating drink but little inferior to the toddy prepared from the Cocoa-nut Palm" (Burbidge, "Gardens of the Sun," p. 317). The author refers to Borneo only, but if Tampoe is *Pierardia dulcis*, it occurs in Java and Sumatra.

Emblica officinalis, Gaertn., (Buah malaka and Kemloco, Malay), is a sour-fruited species of the EUPHORBIACEÆ, which grows abundantly round Malacca; Malaka is one of the native names both in Sundanese and in Malay. The tree is ornamental enough with its feathery distichous leaves; but the green fruits seemed to my taste too sour to be palatable. The genus *Garcinia* has many species, perhaps ten or twelve, in Malaysia which may be said to be the head-quarters of the well-known Mangosteen, a name derived from the Malay mangis, which with little modification is found in all Malayan dialects. The fruit is found throughout the equatorial region as far as 14° N. and S. latitude; but Mindanao is the only island of the Philippines in which it succeeds. For those who do not know the fruit it may be described as one of the most luscious, while the tree is particularly ornamental. In July, August, and September it is abundant in the markets and cheap. Another fruit belonging to the same family is *Stalagmites dulcis*, Camb., the Mundu of Java and Gledok or Gertok-pantok of Sundanese Malay, an evergreen tree 40 to 60 feet high, frequent in the forests up to 3000 feet. It yields a superior quality of gamboge, fruiting in February, and bearing a four-celled berry about an inch in diameter. This must not be confounded with *Garcinia dulcis*, Kz., an equally common tree bearing a berry the size of a lime, smooth, bright yellow, with from one to five large seeds in a yellow fleshy pulp. In the same

order we find *Calophyllum inophyllum*, L., a tropical species which is widely spread in Asia, with a globular fruit the size of a plum. It is equally common in tropical Australia. It grows close to the sea-margin, and being a tree of splendid foliage and handsome white flowers, is a conspicuous ornament. The fruit however is not of much value. The Malay name is Betau. Amongst the GUTTIFERÆ there are other fruit-trees of interest of which want of space compels the omission. One of the MELIACEÆ calls for a little remark, and that is *Sandoricum indicum*, Cav., the Sattul of the Malays, found throughout the region. It is valued for a yellow apple-like berry containing five nuts; but it is not very palatable, being somewhat like a sour Mangosteen. Another much more important member of the order is *Lansium domesticum*, or Langsat, Lanse, or Ayer-ayer, a fruit growing in clusters, of yellowish colour, containing a tenacious juicy aril. It has a pleasant, sweetish flavour, much esteemed by the Malays.

The order SAPINDACEÆ gives a good many useful and esculent members. First of all is the Rambutan which is the Malay name for a fruit cultivated abundantly throughout Malaysia on a tree of medium size. It is peculiar to the region, like the Durian and Mangosteen. Like the Langsat the edible portion is the aril. This is semi-transparent and of agreeable flavour; but small in quantity, and rather too tenacious to be pleasant eating. The husk is scarlet in colour, covered with a kind of shaggy coat, and has a decidedly attractive appearance as seen in some of the crowded orchards around Penang. The name is derived from the Malay word for hair. The botanical name is *Nephelium lappaceum*, L. The wood has not much solidity, and therefore is little used. What the Malays call Rambutan-utan is *Xerospermum noronhianum*, Bl., a shrubby tree about 20 feet high, with a compact durable wood much used in carpentering. *Lansium domesticum*, Bl., is thought to be the finest fruit in the Peninsula, or at any rate ranking next to the Mangosteen. The fruit lies in clusters on the trunk and branches, being of a moderate size, and having the edible part inside of a tough buff-coloured husk or rind. The Rambi is another variety of the same tree. When the Langsat,

Rambi, or Duku is cultivated in richly manured ground, the fruits have comparatively thin and small seeds or nuts, while the edible part is much augmented. The Li-chi (*Nephelium litchi*) does not grow in Malaysia, though it finds its way in quantities from south China to Singapore, and is seen abundantly in the markets in July and August. This fruit appears to me to be the most palatable of any in the East, deserving the saying of Warren Hastings that it was almost the only fruit which deserved to be regretted even amidst the plenty of Covent Garden.

Anacardium occidentale, L., the Jambu-monjet of Malays and the Cashew-nut of English, is a native of South America, which is quite naturalised in Malaysia, so that one sees the fruit in all the markets about the month of April. This has a very peculiar appearance, being like a yellow or reddish fig, bearing at its base a kidney-shaped seed. The sweet kernel inside is protected by a husk saturated with an indescribably acrid oil, which corrodes iron rapidly and marks linen with ineffaceable stains. The Pomme d'Acajou, as the French call it, though attractive in appearance and sweet to the taste, leaves a painful irritation on the throat, so that they are seldom eaten raw. The green fruits are very astringent, and serve to tan leather as well as to fix dyes in fabrics. The ripe fruit used as a preserve is excellent and wholesome. The nut is parched on a pan, and so is used as a substitute for chocolate or as a means for its adulteration. The Malays call the nut Casoe.

Semecarpus anacardium, L., (Rengas meira, Malay), or the Marking-nut, has become naturalised in Malaysia, and bears racemes of what look like small Pommes d'Acajou the ripe fruit of which is eaten. The mature corolla and receptacle are fleshy and of a sweetish sour taste, but producing, unless cooked, much subsequent irritation of the throat. The kernel of the nut can be eaten, but scarcely with safety uncooked, for the juice contains an acrid, viscid oil, used as an escharotic, which leaves a mark for life on the skin, and often intractable and painful sores. It is used as a medicine for elephants, but in excessive doses renders them

furious. The pollen of the flowers is very narcotic and irritating, affecting some people to a dangerous extent, since by only going near the flowers they become stupefied and their limbs swollen. It is considered dangerous to cut down the tree or even to work upon the wood; in fact everything about this tree is so poisonous that it seems to realise the exaggerated fables about the Upas-tree. *Semecarpus cassuvium*, Spreng., (Daun sako, Malay), the Malacca or Marsh-nut of the French, now naturalised in the Moluccas, Banda and Ceram, from the Antilles, has similar properties, and is said to be a brain stimulant, giving memory and wit to fools like the elixir of the Arab doctor Mésué.

After all that has been written about the well-known Mango (*Mangifera indica*, L., and Manga, Malay) a mere reference will suffice in this essay. The species are about 14, including *M. indica* and its many cultivated varieties, *M. fœtida*, Lour., the Horse Mango of the Malays, of which natives of Malaysia and India are very fond notwithstanding its offensive odour and seriously deleterious qualities. The genus is entirely Malayan; the best are cultivated in the Philippines and in Java, while they seem unable to grow good fruit in the Malay Peninsula. There is a considerable export of Mangoes from Manila, which proves the esteem in which they are held in the neighbouring countries, but I have never seen fruit superior to that which I obtained in Java.

Bouea gandaria, Bl., the Gandaria of the Malays is a kind of Mango; the fruits are esteemed by the natives, and the young leaves are eaten with rice in Java and Borneo. *Dracontomelon-mangiferum*, Bl., or Buah rau, known to most botanists as *Poupartia*, bears a kind of edible Mango eaten in the Moluccas. This is the Dragon-tree (Drakenboom) of Valentyn, who says that the fruit when newly gathered is highly refreshing. *Evia acida*, Bl., is the Kedondong of the Javanese and the Pomme de Cythère of the French, which is cultivated and almost naturalised in Malaysia though probably introduced from the Society, Friendly, or Fiji Islands. It is like a large plum and contains a stone, but coloured like an apple, and covered with long hooked bristles.

The flavour resembles that of the Pine-apple. This is the Hog-plum or Tahiti Apple, better known to botanists under the name of *Spondias dulcis.*

Mata kuching or Cat's-eye, the well-known Jungle-nut, growing in close racemes, consisting of a triangular drupe containing a single bony one-seeded nut with an opalescent kernel from which the name Cat's-eye is derived. This is *Canarium commune*, L., belonging to the BURSERACEÆ, an order much resembling the Orange tribe, but whose fruit has a shell which splits into valve-like segments. The three-cornered nuts are eaten safely when cooked, and an oil obtained from them which is eaten when fresh, and burned when stale. Myrrh and frankincense are also derived from the gum. There are several species of *Canarium*, a name which seems to be derived from the Malay word Kanari, the Java almond. The resin is called Gum-elemi in India. Another species is called Kanari minjak by the Malays, and another in the Moluccas Kanari-itam and Damar-itam, and Damar gala-gala; while, according to Bisschop Grevelink, *Canarium dichotomum*, Miquel, is the species to which the name of Damar mata kuching is applied. In the same order is *Protium javanicum*, Burm., the Tingulong of the Malays, a stout tree of medium height which grows in Java and the Moluccas. The fruit, though edible, is but little esteemed, yet it yields an aromatic essential oil with many uses.

The large order of RUBIACEÆ scarcely furnishes any fruits of importance, and of these none are known in Malaysia either indigenous or cultivated. *Sarcocephalus* is a genus well represented in the province, but the fruit-bearing Native Peach of Africa, *S. esculentus*, has not come into use. Two species of *Morinda*, which are very abundant on the coast (*M. citrifolia*, and *persicæfolia*), one of which is widespread in Australia and serves as a fruit for the natives, are common.

Amongst the SAPOTACEÆ *Achras sapota*, L., or the Sapodilla Plum, (in Malay Chicos, Javanese Sawo) is extensively cultivated in and around Malacca, though it is a plant of West Indian or Central American origin. It is a tall straight tree without knots

or branches for 20 feet or so; and the head then spreads into small branches; the bark dark grey, full of cracks; fruit oblong, covered with a thick brownish-grey rind, the flesh is yellow as a carrot, with two stones like almonds, very fragrant. The taste is relished exceedingly by the Malays; but is like brown sugar. When fresh gathered it is extremely acrid, and a white clammy juice exudes from the broken skin. This is a true Gutta and very adhesive. The fruit is then hard, but by being kept it becomes soft and sweet like a medlar, losing its astringency, a process hastened by burying in sand. The seeds are in the centre. The Chicos are highly esteemed throughout Malaysia. It is best known in the Philippines where probably it was first introduced. The species called the Naseberry has fruit in shape and size like a Bergamot Pear. This is *Achras zapotilla, Achras* being the name of the wild Pear, and the specific name is from the Mexican Zapotl. It is a wonder that Europeans have not introduced *A. mammosa*, the Mammy Apple or American Marmalade, which is so highly esteemed in the West Indies. It bears a large, oval, brownish fruit, with a thick russet-coloured pulp called Natural Marmalade, and very luscious to the taste. In Malacca it is said that a Sapotilla tree is one of the most profitable grown, as one will produce fruit of the value of £50 in a season. The order of SAPOTACEÆ has some indigenous representatives in Malaysia, including species of *Isonandra* and *Bassia*, both of which are Guttas, producing valuable varieties of gutta percha. *Isonandra gutta*, Hook., Balam tambaga of the Malays, besides other species of that genus and of *Bassia*, are met with in the Peninsula, Sumatra, Borneo, &c.; but the trees are being destroyed by the natives who collect the juice in a most wasteful manner.

Diospyros kaki, the Persimmon or Date-plum, the Caju Sawu of Java, is a tree which grows abundantly on the southern coasts of the island of Bali, and in the western and low lands of Java. The Sawu loves a humid soil near the beach, and seems to grow especially well in the islands of the Bay of Batavia, where the trunk acquires considerable thickness; but Bali and Java seem to be the only parts of Malaysia where it thrives.

Finally, though somewhat out of place, *Averrhoa carambola* and *A. bilimbi*, the Carambola trees of the English and the Blimbing and Bainan of the Malays, bear an odd-looking winged green fruit, containing an acid pulp which is somewhat insipid; but the trees themselves are very ornamental.

In this list some omissions have been necessary to bring it within reasonable limits; but none of the more important fruits have been passed over. The different varieties of Plantains and Bananas would require a separate treatise, while the Cocoa-nuts are identified more with the vegetable products. Nanas, as the Malays call the Pine-apples (*Ananassa sativa*, Lindl.), is of course widely diffused amongst them. Their name is identical with the Brazilian one, obtained through the Portuguese, who introduced it into India in 1594. Altogether it is not a favourite fruit in Malaysia, since it is certainly not seen in its perfection in those regions. A peculiar variety introduced by Sir Hugh Low is commonly seen as an ornament upon the table. It is called the Hen and Chickens on account of the odd mode of growth which it manifests. There is a tall conical central pine, and, at its base, four or five small pines spring forth, but the fruit is for ornament only.

HORTICULTURE.—The English and Dutch colonists have always been remarkable for the cultivation of flowering plants. This peculiarity has resulted in the ornamental or neat and beautiful appearance which roads and streets, gardens and enclosures invariably bear in the colonies of the above nations. The taste thus manifested is of ancient date; but it has grown, and probably has never previously attained such activity in the cultivation of native flowers, and the introduction of new ones as at present. Yet in the Straits Settlements and Dutch colonies acclimatisation has not progressed as it should have done. Persons who possess every advantage, and might have gardens of pre-eminent variety and beauty, confine their attention to a few common and easily grown species, so that one sees the same things over and over again. Masses of *Hibiscus rosa-sinensis*,

Poinciana regia and *pulcherrima*, *Duranta plumieri*, *Bougainvillæa glabra*, *Plumieria acutifolia*, and the same *Clerodendrons* meet one with tiresome monotony on every side, and nothing else. Splendid exotics are within the reach of every one without much trouble or expense, since the work has already been begun by a few. I made many lists of the flowers in cultivation in the gardens of the Straits Settlements especially, and I was equally astonished and disappointed to find how meagre the catalogues were, and at the endless repetition of the same plants. Combining these together, the following list will give an idea of the floral adornments of the gardens of Malaysia. I shall take the opportunity of making a few comments on some of the species as they occur. Species marked * are naturalised. Where the species of an order are few, several orders are grouped together.

Nymphæa lotus, *N. pubescens*, *N. stellata*, and *Nelumbium speciosum* are found in all gardens where there are ornamental waters.

Magnolia fuscata, *M. pumila*, and *Michelia champaca* are in most gardens cultivated for their fragrance. *Bixa orellana*, *Pittosporum undulatum*, *Portulaca grandiflora*, *Garcinia* (many species), *Adenandra dumosa*, *Camellia japonica*, *Abutilon venosum*, *Hibiscus rosa-sinensis*, *Stigmaphyllon ciliatum*, *Canarium commune*, *Melia composita*.

LEGUMINOSÆ.—*Clitoria ternatea*, *Cassia fistula*, *Poinciana pulcherrima* and *P. regia*, *Ceratonia siliqua*, *Bauhinia* (many species), *Amherstia nobilis*. [This last forms one of the most attractive things in flowering trees that is possessed by the East. Don is almost justified in saying that when in foliage and blossom it is the most superb object imaginable, not surpassed by any plant in the world. It is probably a native of Burmah, and was found originally in the garden of a Buddhist monastery. Yet its native place is still uncertain. It is an unarmed tree some 40 feet high, with large abruptly pinnate narrow leaves with six to eight pairs of leaflets, and long pendulous drooping terminal racemes of showy flowers. These are very handsome, of fine

vermilion colour diversified with yellow spots, and a soft velvety appearance. The bracts are also highly coloured and persistent. The latter are a pair, one and a half inches long, broadly lanceolate and crimson, the whole forming long drooping racemes at the ends of the branches]. Also *Lucœna glauca*, *Inga dulcis.*

Hydrangea japonica, *Bryophyllum calycinum*, *Rhodoleia championi*, *Combretum grandiflorum*, *Rhodamnia trinervis*, *Rhodomyrtus tomentosa*, *Lawsonia inermis*, *Lagerstrœmia floribunda*, *L. indica*, *L. reginæ*, *Punica granatum* (Pomegranate, white and red varieties), *Turnera trioniiflora*, *Passiflora* (many species), *Trichosanthes laciniosa*, *Begonia* (many species), *Opuntia* (many species) and other Cactaceæ.

Panax fruticosum, *Aucuba japonica*, *Lonicera chinensis* (the Chinese Honeysuckle), *Rondeletia odorata*, *Gardenia* (many species), *Ixora alba*, *I. coccinea*, *I. rosea*, and others.

COMPOSITÆ.—*Helianthus tuberosus*, *H. annuus*, *Chrysanthemum sinense*, *Eupatorium glandulosum*, *Gaillardia bicolor*, *Coreopsis coronata*, *Dahlia excelsa* (Tree Dahlia) and other species, * *Zinnia multiflora*, *Z. elegans* and other species, *Cichorium intybus*, *Rudbeckia laciniata*, *R. hirta*, *R. columnaris*, *Silphium terebinthaceum*, *Craspedia glauca*, *Centaurea depressa*, *Ageratum mexicanum*, *Farfugium grande*, *Tagetes patula*, *T. erecta*, *Helichrysum* (many species), *Cineraria sinensis* and other species.

Rhododendron javanicum, *Plumbago capensis*, *P. rosea*, *Ardisia* (many species), *Jasminum* (many species).

APOCYNACEÆ.—*Allamanda aubletii*, *A. cathartica*, *A. nobilis*, *A. schottii*, *A. neriifolia*, *A. violacea*, *Ochrosia elliptica*, *Wrightia coccinea*, *Echites* sp., *Mandevilla suaveolens*, *Willughbeia edulis*, *Cerbera odollam*, *Kopsia fruticosa*, *Vinca rosea*, *Plumieria acutifolia* (commonly called the Frangipanni, which it is not; planted in all cemeteries), *Tabernœmontana coronaria*, *Nerium oleander*, *Beaumontia multiflora.*

Calotropis gigantea, Stephanotis floribunda, Pergularia odoratissima, Hoya carnosa (and other species), *Heliotropium peruvianum, Ipomœa* (many species both from the jungle and exotic), *Jacquemontia violacea,* and *Porana volubilis* or the Bridal Wreath, a climbing shrub bearing dense racemes of small white delicate or waxy-looking flowers. This is a very beautiful species, a native of Burmah, but much cultivated in Malaysia. The closely packed racemes of white flowers, though small are exceedingly attractive.

Solanum jasminoides and many other species, *Solandra grandiflora*, *Datura* sp., *Brugmansia arborea* and other species, *Brunfelsia eximia, Habrothamnus newellii, Juanulloa mexicana, Cestrum candidum, Angelonia floribunda* and others, *Pentstemon* (many species), *Russelia juncea* (the Corallitos of the Spaniards; this has become quite a part of the native flora in Borneo and the Philippines), *Torenia asiatica, T. baillonia,* and *T. polygonoides.*

The climate being exactly suited to the GESNERACEÆ, which flower easily in the open air though requiring shade, they are well represented, but not as extensively found in every garden as they should be. *Gloxinia* with its many varieties, *Achimenes cherita* and its varieties, *Tydœa picta* and varieties, *Gesnera cinnabarina, G. oxoniensis, G. refulgens, G. zebrina, Cyrtandra glabra, Cyrtodeira fulgida, Æschynanthus* (all of the species which the jungle produces).

BIGNONIACEÆ.—*Bignonia venusta, B. grandiflora, B. radicans* and other species, *Tecoma australis, T. capensis, T. jasminoides, T. tweediana;* the latter I saw only in gardens in Menado, Celebes.

ACANTHACEÆ.—*Thunbergia alata, T. grandiflora, T. harrisii, T. laurifolia, Meyenia erecta, M. vogeliana, Sanchezia nobilis,* * *Barleria cœrulea* and other species, *Crossandra infundibuliformis, Asystasia coromandeliana, Eranthemum* (many species), *Aphelandra cristata, A. fascinator, Justicia coccinea, Rhinacanthus communis, Cyrtanthera pohliana, Fittonia argyroneura, Graptophyllum hortense.*

VERBENIACEÆ.—*Lantana* (many species), * *Stachytarpheta indica, S. jamaicensis, S. mutabilis, Duranta plumieri* (both the blue and white varieties), *Petrœa volubilis, Clerodendron* (many species).

LABIATÆ.—*Coleus* (many species), *Salvia coccinea, S. barbata* and other species.

NYCTAGINEÆ.—*Mirabilis jalapa*, *Bougainvillæa glabra.*

EUPHORBIACEÆ. — *Acalypha marginata, A. indica* and other species, *Croton* (many species), *Manihot utilissima, Jatropha curcas, J. multifida, Euphorbia splendens, E.* (*Poinsettia*) *pulcherrima.*

Amongst the CONIFERÆ the usual Pines, Cypresses, and other genera commonly in cultivation are met with, the favourites being *Cupressus lignum-vitæ,* and *Cryptomeria japonica.*

ENDOGENS.

Canna indica and other species, *Maranta* (many species, in the Straits as elsewhere great favourites amongst the plants cultivated for their foliage), *Alpinia nutans, Costus speciosus, Heliconia bicolor, H. sanguinea* (with large magnificently coloured flowers closely allied to Banana), *Urania speciosa* or the Traveller's Tree, as well as *Strelitzia angustata,* which it somewhat resembles in habit, are much in cultivation round Singapore.

Having dealt with the Orchids we may pass by the Bromeliads, of which a good many are in cultivation. Amongst the AROIDEÆ many species of *Alocasia* and *Caladium* are cultivated for their foliage, *Richardia æthiopica.*

LILIACEÆ.—*Yucca aloifolia, Y. brevifolia, Y. glaucescens, Lilium longiflorum, L. washingtonianum, Agapanthus umbellatus, Blandfordia cunninghamii, B. flammea, B. nobilis, Aloe carinata, Dianella cærulea, D. ensifolia, Cordyline albicans, C. ensifolia, Dracæna* (many species), *Tradescantia discolor.*

AMARYLLIDEÆ.—*Clivia nobilis, Imantophyllum miniatum, Doryanthes excelsa, D. palmerii, Agave americana, Fourcroya gigantea, Amaryllis belladonna, A. hippeastrum, A. ignescens, Zephyranthes rosea, Vallota purpurea, Eucharis amazonica,*

Alstrœmeria aurea, A. braziliensis, Crinum amabile, C. asiaticum, C. ornatum, C. pedunculatum, Eurycles australis, E. cunninghamii, Pancratium biflorum, P. malabaricum, P. speciosum.

Ferns and Lycopods are as extensively cultivated in the Straits Settlements as Orchids, and the number and variety of indigenous kinds is as great as in any part of the world, so that this branch of horticulture is very popular and successful.

SEED-PLANTS.—Plants cultivated for their seeds would make a very extensive list if we include the cereals, such as *Triticum, Panicum, Setaria, Sorghum, Zea mays, Oryza,* and the legumes such as the Peas *(Pisum arvense, sativum,* &c.), the Beans *(Phaseolus),* Pigeon-pea *(Cajanus indicus),* the Soy *(Dolichos soja),* Buckwheat *(Polygonum fagopyrum),* &c. In this essay no more can be done than to enumerate a few of the most common.

Coffea arabica cultivated extensively in Java, but more sparingly in all the other islands. Strange to say, Blanco thought it indigenous in the Philippines. It is a native of Abyssinia.

Theobroma cacao or Cocoa is extensively cultivated all over Malaysia.

Gossypium herbaceum, L., Algodonero, a Spanish word which is in use by all the Philippine Indians; in nearly all the Malay dialects Kapas and Kabu-kabu; in Bengali Kapase; in Hindostanee Kapas, all derived from the Sanskrit word Karpassi; Arabic Kutn whence Coton and probably Algodon; Chinese (Punti) Min; Mandarine Mien; Japanese Wata and Momen. Probably its original habitat was Malaysia. Two exhaustive works have appeared on the subject lately in Italy, one by Parlatore* and the other by Todaro.† The former admits seven well-known species and two doubtful, while Todaro counts

* Monogr. delle specie d. Cotoni, 4to. Florence, 1866.

† Relaz. della coltura dei Cotini in Italia con monographia del genere Gossypium. 8vo. Roma, 1877.

fifty-four, only two of which are doubtful, reckoning as species forms which originated in cultivation and are permanently preserved. *G. herbaceum* is the species most cultivated in the United States, *G. indicum* in China and Japan; but these determinations are doubtful. The natives of all the East from India to Japan depend upon it as one of the great staples of agriculture.

Papaver somniferum derived from *P. setigerum* which is wild on the shores of the Mediterranean; cultivated from the most ancient times.

Mere mention can only be made of the following: *Sesamum indicum* cultivated for oil, Nutmeg *(Myristica fragrans)*, *Aleurites moluccana* cultivated for the oil in its seeds, *Jatropha curcas* yielding a medicinal oil used also in lamps.

CULTIVATED ROOTS.—*Colocasia antiquorum* is cultivated for the edible rhizome and the swelled lower portion of the stem. The leaf-stalks and young leaves are also eaten as a vegetable when cooked. It belongs to the flora of south Asia, but its use has spread over the warmer islands of the Pacific, the West Indies and tropical America. *Alocasia macrorrhiza*, Schott, is another of the esculent aroids, less frequently cultivated than the first-named; but in the same manner, and nearly in the same countries. The rhizomes attain the length of a man's arm. They must be cooked until all bitterness is removed, or they are poisonous. (De Candolle). "The Malay names of the first-named species are kelady, tallus, tallas, tales or taloes, from which perhaps comes the well-known name of the Otahitans and New Zealanders—tallo or tarro, dalo in the Fiji Islands. The Japanese have a totally distinct name, imo, which shows an existence of long duration either indigenous or cultivated."* *Alocasia indica*, Schott, with three varieties mentioned by De Candolle, is cultivated equally with the former.

* De Candolle, "Origin of Cultivated Plants," p. 74.

Ipomœa batatas, L., is the well-known sweet potato belonging to the order of CONVOLVULACEÆ, largely cultivated amongst the Malays, likewise in all countries within or near the tropics. The Malay name is Ubi, which is also applied to the common potato; Keledek is the common Malay name for the sweet potato. The origin of this plant, universally cultivated in the tropics, is extremely doubtful. The whole question is given in De Candolle *op. cit.* He gives the Chinese name as Chu; in Punti I find it is Fan-shu; in Japanese it is called Satsuma-imo, and common potatoes Riukiu-imo.

LICHENS.—In a moist climate and amid such shady forests as those of Malaysia it may be readily imagined how rich the harvest of lichens ought to be; but very little has been done towards their determination. I made no collection except a few specimens which have not been determined. I give here therefore the list of genera of those enumerated by Nylander and Crombie from Vol. XX., p. 48, of the "Journal of the Linnean Society," (Botany), London. These were collected in the Straits Settlements by Dr. Maingay about twenty years previously, or between 1861 and 1865. Amongst them was a number of new species.

Family Collemacei: *Collema* 2 species, *Dichodium* 1, *Leptogium* 2.

Fam. Lichenacei: *Ramalina* 1, *Usnea* 2, *Parmelia* 10, *Physcia* 1, *Pyxine* 2, *Pannaria* 1, *Lecanora* 5, *Thelotrema* 2, *Ascidium* 1, *Coccocarpia* 5, *Lecidea* 10, *Gyrostomum* 1, *Graphis* 8, *Medusula* 1, *Opegrapha* 1, *Arthonia* 4, *Glyphis* 4, *Chiodecton* 1, *Verrucaria* 15, *Trypethelium* 4, *Endococcus* 1.

This collection can only be considered as an instalment of the lichen flora of the region, but it is interesting as affording a good specimen of its character. It will be observed also that amongst them common and well-known species of commercial value such as *Parmelia tinctorum*, Despr., and other world-wide species were found. The largest number of species came from about Malacca and Singapore.

FUNGI.—It is impossible to give any complete or satisfactory account of the fungi of the Malayan region. A little has been done here and there, but nothing like a systematic collection of the whole region. Dr. Hooker has collected in the Himalayas, Junghuhn in Java, a little is known of the Philippines and some portions of the Indian Archipelago, but the knowledge is too fragmentary to be of much service. During my travels I was able to make a few observations on the species seen in the jungle, and I have a very few drawings of some of the more perishable kinds. The result of all is that no more can be offered here than a few general and fragmentary observations.

Although heat and humidity influence all kinds of vegetation, yet heat, says Mr. Cooke, seems to exert a less, and humidity a greater influence on fungi than on other plants.* Moisture and cultivation affect their growth in most civilised countries; but in the Malayan region the great influencing causes are moisture, shade, and decaying vegetation. In Java Junghuhn found them most prolific at an elevation of 3,000 to 5,000 feet, and Dr. Hooker remarked that they were most abundant at 7,000 to 8,000 feet above sea-level.

In tropical countries Agarics are not so numerous as *Polyporus*, *Lenzites*, &c. *Coprinus* is equally common everywhere. The genus *Marasmius* is most abundant in the tropics, which is also the principal centre of *Lentinus* and *Lenzites*. The *Polypori* living for the most part upon trees present the most varied forms, while many species are noticed of *Hexagona*, *Favolus*, and *Laschia*. Travellers will not fail to notice the great abundance of species of *Hirneolæ*, especially *H. polytricha*, Fries, on logs and fallen timber. It is largely collected by the Chinese and sold in the markets. The species is so abundant in Malaysia, and is so valued in China that a trade might be easily established. *H. auris-judæ* is also common. This is the species which is exported to China from

* "Fungi, their Nature, Influence, and Uses." By M. C. Cooke. London, 1875.

Tahiti. There are many other edible species used by both Chinese and Malays. The well known *Polyporus lucidus* is as common as in Europe, and one constantly meets with *P. cinnabarinus*, Fries, with its brilliant vermilion hymenium. *Schizophyllum commune* is found almost everywhere. Probably there is no plant, and certainly no fungus, so extensively diffused over the world. The Phalloidei are pretty numerous, and as usual conspicuous for their form and colour. Two or three species of *Morchella* are used for food and perhaps the large truffle-like *Mylitta.*

Java has been the best explored for fungi where Junghuhn records 117 species in 40 genera, Nees von Esenbeck and Blume 11 species in 3 genera, and Zollinger and Moritzi 31 species in 20 genera, making a total of 159 species, of which 47 belong to *Polyporus.* Léveillé added 87 species, making a total of 246 species. The fungi of Sumatra, Borneo, and other islands are partly the same and partly allied, but of a similar tropical character. Cooke is my authority for these figures who quotes Junghuhn, "Premissa in Floram Crypt. Javæ," and Zollinger, "Fungi Archipelagi Malaijo Neerlandici novi."

EXPLANATION OF PLATES.

Fig. 1. Fruit of *Dipterocarpus* sp.
Fig. 2. *Dryobalanops aromatica*, Steud.
Fig. 3. Ditto, long section of fruit.
Fig. 4. Fruit of *Quercus angustata*, Bl.
Fig. 5. ,, *Q. glaberrima*, Bl.
Fig. 6. ,, *Q. placentaria*, Bl.
Fig. 7. ,, *Q. elegans*, Bl.
Fig. 8. ,, *Q. rotundata*, Bl.
Fig. 9. ,, *Q. induta*, Bl.
Figs. 10-11. ,, *Q. costata*, Bl.
Fig. 12. ,, *Q. platycarpa*, Bl.

EXPLANATION OF PLATES—*continued:*

Fig. 13. Fruit of *Q. daphnoidea*, Bl.
Fig. 14. ,, *Q. gemelliflora*, Bl.
Figs. 15-16. ,, *Q. turbinata*, Bl.
Fig. 17. ,, *Q. pallida*, Bl.
Fig. 18. ,, *Q.* sp.
Fig. 19. ,, *Q. pruinosa*, Bl.
Fig. 20. ,, *Q. sundaica*, Bl.
Fig. 21. ,, *Q. pseudomolucca*, Bl.
Fig. 22. *Eugeissona triste*, Griff.
Fig. 23. Fruit of *Eugeissona triste*, Griff.
Fig. 24. *Licuala peltata*, Griff.
Fig. 25. *Ataccia cristata*, Kunth.
Fig. 26. *Cypripedium sanderianum*, Reichenb.
Fig. 27. *Uropedium lindenii*, Lindl.
Fig. 28. *Cypripedium caudatum*, Hartw.
Fig. 29. *Medinilla magnifica*, Lindl.

NOTES ON THE GEOGRAPHICAL DISTRIBUTION OF SOME NEW SOUTH WALES PLANTS,

COMPILED FROM INFORMATION SUPPLIED BY W. BAUERLEN, AND FROM SOME DIAGNOSES BY BARON VON MUELLER, K.C.M.G., F.R.S., &c.

BY J. H. MAIDEN, F.L.S., &c.

The local Floras, or the notes to aid the compilation of local Floras, which have already appeared in the Proceedings of this Society are of great value, and it is to be hoped that such efforts may be greatly extended. While much of New South Wales is virgin country, yet in many districts the indigenous plants are being removed either because they are destroyed, or are supplanted by introduced species. The circumstances of this colony are very different to those of England, in which there are Floras for almost every county, and for much smaller areas, but notes on the geographical distribution of plants are much required here also, and I make no apology for the few which follow.

I.

List of species which find their most *southern* limit in that region of the Clyde and Braidwood district, where the sandstone formation ends.

HIBBERTIA SALIGNA, *R.Br.*
DORYPHORA SASSAFRAS, *Endl.*
COMESPERMA SPHÆROCARPA, *Steetz.*
MELIA AZEDERACH, *Linn.*
CEDRELA AUSTRALIS, *F.v.M.*

*Boronia pilosa (new for N.S.W.), *Labill.*
*B. rhomboidea (new for N.S.W.), *Hook.*
B. Barkeriana, *F.v.M.*
Monotaxis linifolia, *F.v.M.*
Poranthera ericifolia, *Rudge.*
Bertya gummifera, *Planch.*
Elatostemma reticulata, *Weddell.*
Peperomia leptostachya, *Hook.*
P. reflexa, *A. Dietrich.*
Dodonæa multijuga, *G. Don.*
Oxylobium cordifolium, *Andrews.*
Mirbelia grandiflora, *Ait.*
M. reticulata, *Sm.*
M. pungens, *Cunn.*
Gompholobium glabratum, *DC.*
Daviesia squarrosa, *Sm.*
Pultenæa pycnocephala, *F.v.M.*
Bossiæa Kiamensis, *Benth.*
Acacia obtusata, *Sieb.*
Rubus Moorei, *F.v.M.*
Callicoma serratifolia, *Andr.*
Schizomeria ovata, *D. Don.*
Bæckea crenulata, *R.Br.*
Kunzea capitata, *Reich.*
Callistemon linearis, *DC.*
Melaleuca thymifolia, *Sm.*
M. linarifolia, *Sm.*
Metrosideros glomulifera, *Sm.* (*Syn.* Syncarpia laurifolia, *Ten.*)
Rhodamnia trinervia, *Blume.*
Pomaderris phylicifolia (new for N.S.W.), *Lodd.*
Astrotricha longifolia, *Benth.*
Didiscus albiflorus, *DC.*

* Probably brought to the Clyde Mountain from Tasmania.

ACTINOTUS MINOR, *DC.*
OLAX STRICTA, *R.Br.*
PETROPHILA SESSILIS, *Sieb.*
CONOSPERMUM TAXIFOLIUM, *Sm.*
SYMPHYONEMA PALUDOSUM, *R.Br.*
PERSOONIA REVOLUTA, *Sieb.*
P. LANCEOLATA, *Andr.*
LAMBERTIA FORMOSA, *Sm.*
GREVILLEA MIQUELIANA, *F.v.M.*
G. LINEARIS, *R.Br.*
TELOPEA SPECIOSISSIMA, *R.Br.*
PIMELEA COLLINA, *R.Br.*
PASSIFLORA HERBERTIANA, *Lindl.*
CASSINIA DENTICULATA, *R.Br.*
STYLIDIUM (CANDOLLEA) LARICIFOLIUM, *Rich.*
DIOSPYROS CARGILLIA, *F.v.M.*
POLYMERIA CALYCINA, *R.Br.*
PROSTANTHERA SAXICOLA, *R.Br.*
CHLOANTHES PARVIFLORA, *Walp.*
STYPHELIA ESQUAMATA, *Spreng.*
WOOLLSIA PUNGENS, *F.v.M.*
DRACOPHYLLUM SECUNDUM, *R.Br.*
EPACRIS CALVERTIANA, *F.v.M.*
E. CRASSIFOLIA, *R.Br.*
DENDROBIUM TERETIFOLIUM, *R.Br.*
THELYMITRA VENOSA, *R.Br.*
CALOCHILUS PALUDOSUS, *R.Br.*
CRYPTOSTYLIS ERECTA, *R.Br.*
PTEROSTYLIS ACUMINATA, *R.Br.*
P. CUCULLATA, *R.Br.*
CALEYA MINOR, *R.Br.*
HÆMODORUM PLANIFOLIUM, *R.Br.*
H. TERETIFOLIUM, *R.Br.*
BLANDFORDIA NOBILIS, *Sm.*
XEROTES FLEXIFOLIA, *R.Br.*
COLOCASIA MACRORRHIZA, *Schott.*

JUNCUS VAGINATUS, *R.Br.*
FESTUCA HOOKERIANA, *F.v.M.*
AGROSTIS BREVIGLUMIS, *F.v.M.*
ARISTIDA RAMOSA, *R.Br.*
*LINDSAYA TRICHOMANOIDES, *Dry.*

II.

The following species find their most *northern* limit in the Braidwood and Clyde district:—

DRIMYS AROMATICA, *F.v.M.*
TELOPEA OREADES, *F.v.M.*
OXYLOBIUM ELLIPTICUM, *R.Br.*
EPACRIS IMPRESSA, *Labill.*
CHILOGLOTTIS GUNNII, *Lindl.*
LOMARIA ALPINA, *Spreng.*

III.

The following are the new species found by Mr. Bäuerlen in the same region. (See p. 111.)

ERIOSTEMON COXII, *F.v.M.*
CORREA BAEUERLENII, *F.v.M.*
PULTENÆA BAEUERLENII, *F.v.M.*
HALORAGIS MONOSPERMA, *F.v.M.*
GREVILLEA RENWICKEANA, *F.v.M.*
HAKEA MACRAEANA, *F.v.M.*

Some of the species named in the first list pass over to the granite formation, but only to a very slight extent. No doubt we have to expect that some of the species enumerated in the list will be found considerably more south still, but there is also no doubt that additional northern species will yet be found in this region, and that they will considerably outnumber the stragglers further south of this region. Even as it is the list shows at a glance the striking and remarkable fact that in that region from the sea-shore to the banks of the Shoalhaven River in the Braidwood district, a very large number of species, so to say, suddenly die out.

* Probably brought to the Clyde Mountains from Tasmania.

It is also interesting to observe that a few months' collecting during two seasons (1885 and 1886), has resulted in the discovery of six new species, every one of which seems to be restricted, as far as is known, to a very small locality.

Eriostemon Coxii is found on the Sugar Loaf Mountain, 3,800 ft., a belt of the shrub encircling the top of the mountain, but not reaching quite up to the top. Below the mountain, on its north-eastern side, is a deep and narrow gorge, and on the highest side forming this gorge, and opposite the mountain, in the deep rich chocolate soil which produces the jungle (locally called "brush"), there are a few more plants of it. These attain the size of trees, being from 20 to 25 feet high, and having a diameter of six to eight inches, while on the mountain, between the rocks, the species remains a shrub from five to eight feet high. When it is considered that the shrub flowers and seeds profusely, it seems a remarkable fact that this species should have remained restricted to so confined a locality. The few plants attaining tree size in the rich soil of the brush are no doubt the offspring of seeds carried from the mountain by birds, the distance from the top of the mountain across the gorge being scarcely a mile.

Hakea Macraeana associates with the preceding species, and is (so far as is known), restricted to the same locality. Mr. Bäuerlen has as yet found only one tree on the south-eastern side of the mountain, at a lower (a few hunded feet) elevation also in the brush, but where the rock crops out again.

Correa Bäuerlenii is so far only known from the steep rocky banks of two creeks taking their rise high up in the mountains between Nelligen and the Sugar Loaf Mountain.

The above three species occur on the granite formation. *Pultenæa Bäuerlenii* occurs in one of the valleys or depressions of a wild mountain called Currockbilly, in a part where there are running streamlets, but where, nevertheless, the mountain is almost destitute of trees. In the same valley *Blandfordia nobilis* finds its southernmost limit. On one of the sides of the valley *Boronia*

pilosa is also found, which, however, with *B. rhomboidea* reaches a little farther north to the Ghunyenara Mountain, into the sandstone formation, where both grow more luxuriantly.

Haloragis monosperma and *Grevillea Macraeana* occur in the plain to the foot of the western (*i.e.*, Braidwood) side of the Clyde Mountains. Both are found not a mile apart, and yet they are not consociate. Conglomerate, granite and quartz occur where the *Grevillea* is found ; granite and sand where the *Haloragis* grows. Both species appear to be much restricted.

It is worthy of remark that in the restricted localities where these new species grow, they are rather plentiful, except perhaps the *Hakea* and *Correa*. There seems little doubt that additional species remain to be discovered in this locality ; indeed Baron von Mueller has in his hands plants belonging to the Rutaceæ, Leguminosæ, Proteaceæ, &c., of which he is only waiting for more material in order to determine them.

If a straight line be drawn from Ulladulla, running from east to west, that line would pretty well form the southern limit of *Telopea speciosissima*, and also the northern limit of *T. oreades*, which latter occurs there as a shrub four to six feet high, with a number of branches springing up from the roots, while on the southern boundary of New South Wales, and in the moist and sheltered valleys of the Gippsland mountains, *T. oreades* occurs from 30 to 40 feet high, and fully 18 inches in diameter. This species is either never found away from the banks of running streams, or, as in Gippsland, on mountain sides almost boggy with moisture, while *T speciosissima* loves dry sandy soil.

DESCRIPTION OF A NEW MOTH OF THE GENUS *PHYLLODES.*

By A. Sidney Olliff, F.E.S.,
Assistant Zoologist, Australian Museum.

The genus *Phyllodes* is chiefly interesting on account of the wonderful variation to which the markings are liable, a variation which is the more interesting as it appears to correspond to more or less definite geographical limits. In the form of the genus which occurs in the Andaman Islands, *P. roseigera*, Butl., there is a red patch on the hindwing touching the anal angle; in the Indian form, *P. consobrina*, Wtw., this patch has a conspicuous white centre; in the *P. cerasifera*, Butl., from Mindanao, the white is greatly increased in size and extends nearly to the inner edge of the red patch; in other forms the white leaves the red patch; and finally, in the Amboynese form, *P. conspicillator*, Cram., (see illustration), we find that the white appears to have travelled quite across the wing. Our Australian form, which is characterised below, continues in the same line of variation, the patch assuming a band-like appearance, and the whole extending itself along the hind-margin of the wing. This singular alteration in the position of the markings or colour-patches was first pointed out by Mr. A. G. Butler, who has adopted the term "chromatropy" to express this particular kind of variation, at the suggestion of Dr. F. Leuthner.*

As the early stages of *Phyllodes* do not appear to be known, it it to be hoped that observers in Queensland will give their attention to the subject. The transformations of several species of the

* Cf. Lepidoptera collected during the recent Expedition of H.M.S. 'Challenger.'—Ann. Mag. Nat. Hist, xi. (5) p. 427 (1883).

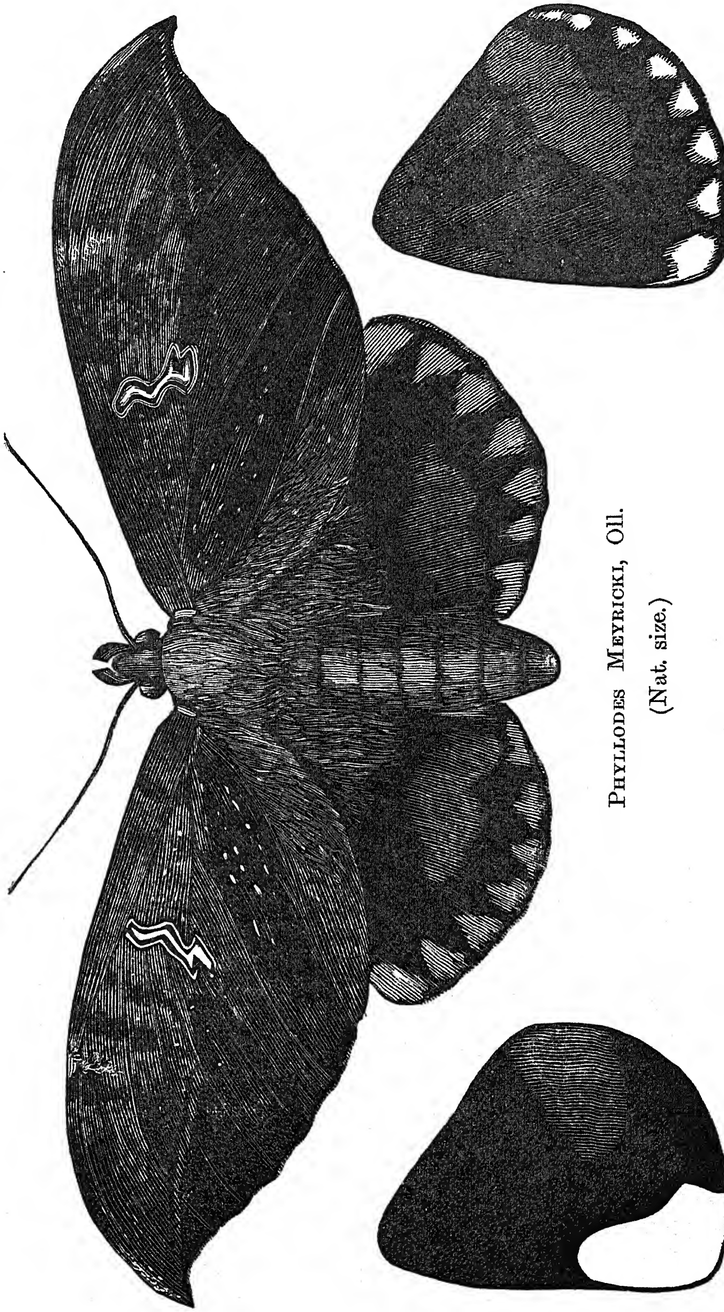
the allied genus *Ophideres* have been described from information obtained in Java and elsewhere; and I may add that a detailed life-history of *O. salaminia*, Cram., drawn up from observations made at Ash Island, in the Hunter River, is contained in the manuscript of the late Mr. A. W. Scott, the publication of which has recently been decided upon by the trustees of the Australian Museum, under the joint editorship of Mrs. E. Forde and myself.

OPHIDERIDÆ.

Phyllodes Meyricki, sp.n.

Antennæ reddish-brown; head between the eyes and the palpi brownish-purple; thorax and abdomen reddish-brown, the latter faintly tinged with purple. Forewing rich reddish-brown, glossed with purple, the red increasing in intensity near the hind-margin, with a somewhat obscure patch of white on the costa at rather less than two-thirds from the base, a similar but even less distinct patch of white at the apex, and an indistinct brown line, edged with reddish, extending obliquely from the apex towards the middle of the wing, and reaching a point just before the stigma, about half-way between the costal and abdominal margins; the stigma greyish-brown, very conspicuous, enclosing two rich brown lines. Hindwing blue-black, inclining to brownish near the base, with a large rosy-pink fascia or band-like marking extending from the inner margin to beyond the middle of the wing, and provided with a row of seven or eight distinct white spots on the hind-margin. Underside coloured much as above, but with the ground colour duller, somewhat lighter, and less rich; the forewing from the base to beyond the middle dark red-brown, tinged with purple, with three white spots in the middle placed obliquely across the wing one behind the other, the last or hind-most being much smaller than the first and second which are large and conspicuous. Expanse of wings 160 mm.; length of body 53 mm.

Mount Bellenden-Ker, near Cairns, and Daintree River, Queensland.



PHYLLODES MEYRICKI, Oll.

(Nat. size.)

2. Hindwing of *P. Meyricki*, Oll.

1. Hindwing of *P. conspicillator*, Cr.

This species is most nearly related to *Phyllodes conspicillator*, Cram.,* described from the island of Amboyna, but it differs so materially in markings from that species that I feel justified in proposing the name *P. Meyricki* for it, as it is now very generally admitted that the practice of distinguishing geographical forms under distinctive names is a good one.

Two specimens of this form are known to me; one from Mt. Bellenden-Ker, collected by Messrs. Cairn and Grant, has been in the collection of the Australian Museum for some time, and more recently a specimen from the Daintree River was forwarded by Mr. C. French to Dr. Ramsay, the Curator of that institution, at whose request I have drawn up the above description.

For the wood-engraving which accompanies this paper the Society is indebted to Mr. J. M. Cantle.

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* The following is, I believe, a complete list of the old-world species of the genus *Phyllodes* described up to this time.

Phyllodes semilinea, Walker, Journ. Linn. Soc. vii. p. 176 (1864). Borneo.

Ph. ornata, Moore, Desc. Lepid. Atkin. ii. p. 166 (1882). Darjiling.

Ph. ustulata, Westw., Cab. Or. Entom. p. 57, pl. 28, fig. 1 (1848). Darjiling.

Ph. Eyndhovii, Vollenh., Tijd. v. Ent. p. 86, pl. 6 (1858); = *Ph. fasciata*, Moore, P.Z.S. 1867, p. 69. Darjiling, Java.

Ph. roseigera, Butl., P.Z.S., 1883, p. 164; Ann. Mag. Nat. Hist. xi. (5), p. 427, fig. 1, hindwing (1883). Andaman Is.

Ph. maligna, Butl., Ent. Mo. Mag. xx. p. 138 (1883). Ceylon.

Ph. consobrina, Westw., Cab. Or. Entom. p. 57, pl. 28, fig. 2 (1848); Butl., Ann. Mag. Nat. Hist., xi. (5), p. 427, fig. 2, hindwing (1883). Silhet.

Ph. cerasifera, Butl., l.c., p. 426, fig 3, hindwing. Mindanao.

Ph. floralis, Butl., l.c., p. 427, fig. 4, hindwing: characters in key only. Borneo.

Ph. Verhuellii, Vollenh., Tijd. v. Entom p. 159 (1858); Butl., l.c., fig. 5, hindwing. Java.

♀ *Ph. conspicillator*, Cramer, Pap. Exot. ii. pl. xcvii. fig. A.B. (1779); Butl., l.c., fig. 6, hindwing; = ♂ *Ph. inspicillator*, Guénée. Amboyna.

Ph. conspicillator, Cram., var. (perhaps a new species), Pag. J.B. nass. Ver. xxxix. p. 138 (1886). Aru Is.

Mr. Brazier read the following "Note on the Linnean *Murex corneus* found living on the coast of the Island of New Caledonia, South Pacific Ocean":—

EUTHRIA CORNEA, Linn.

1766. *Murex corneus*, Linn. Syst. Nat. ed. 12, p. 1224, No. 565.

1791. *Murex corneus*, Gmelin, Syst. Nat. p. 3552, No. 97.

1822. *Fusus lignarius*, Lam. Anim. sans Vert. VII., p. 129, No. 24.

1832. *Fusus lignarius*, Kiener, Coq. Viv., *Fusus*, p. 43, No. 35, pl. 22, fig. 1.

1843. *Fusus lignarius*, Lam. Anim. sans Vert. 2nd ed. IX., p. 455, No. 24.

1847. *Fusus lignarius*, Reeve, Conch. Icon. IV., pl. 2, fig. 5.

1855. *Murex corneus*, Linn.; Hanley, Ipsa Linnæi Conch. pp. 305-525.

1855. *Euthria lignaria*, H. & A. Adams, Genera of Moll. I., p. 86, pl. 9, fig. 7b.

1869. *Fusus corneus*, Linn.; Petit de la Saussaye, Catalogue des Mollusques Testacés des Mers d'Europe, p. 161.

1881. *Euthria cornea*, Linn.; Tryon, Manual of Conch. III., p. 149, pl. 72, fig. 218.

"The beautiful shell exhibited was obtained alive by my kinsman, Mr. R. C. Rossiter, at Wagap, East Coast of New Caledonia, under the same stone with *Pisania buccinulum*, Martini (= *Pisania ignea*, Gmelin). The specimen is mottled and marbled all over with dark brown and white, below the suture merging into a band on the last whorl. The interior of the aperture is of a fine bright purple-brown more inclined to dark violet; it corresponds exactly with the external figure given in Tryon's Manual, and the figure given in Kiener's "Coq. Viv.;" but none of them show such magnificent

internal colouring as the specimen before me. Those in the Museum from the Mediterranean Sea are very poor; a specimen from Barcelona, Spain, (Coll. Brazieræ), is of very fair colour on the outside like the New Caledonian one. There appears to be some confusion among authors in reference to the specific name of this species. *Murex lignarius*, Linn., is a *Fasciolaria* of authors, therefore *Fasciolaira lignaria*, Linn.; it was redescribed by Lamarck as *Fasciolaria Tarentina;* and the *Murex corneus*, Linn., has been taken as *lignarius*. The Linnean descriptions it is true are very brief, but they are to the point as regards *M. corneus* and *lignarius*, as pointed out by Mr. Hanley in his "Ipsa Linnæi" in 1855. We have already on the coast of New South Wales a common Mediterranean shell in *Triton costatus*, Born., whose range extends to Lord Howe Island, 450 miles east of Sydney."

Mr. Brazier also exhibited specimens of the Cuban land-shell *Subulina octona*, Chem., obtained at Nakety, east coast of New Caledonia, by Mr. R. C. Rossiter, examples of which from another locality, also in New Caledonia, were exhibited at the Society's meeting in October last (*vide* Abstract for October 31st, 1888).

Mr. Whitelegge exhibited a specimen of *Voluta fusiformis*, containing a very rare hermit crab, *Clibanarius strigimanus*, White, previously recorded only from Bass's Straits. On the feet of the crab are a number of specimens of *Paecilasma fissa*, Darwin, a rare cirripede previously only known from the Philippines. On the surface of the shell are specimens of a species of *Balanus*, and of an hydroid zoophyte, *Hydractinia levispina*, Carter, the exact habitat for which species was not known at the time it was described. He also exhibited another rare cirripede, *Dichelaspis orthogonia*, Darwin, a species described in 1851, its habitat being unknown. It does not appear to have been obtained since it was described. There are five clusters in the Australian Museum attached to as many fragments of the stems of a species of *Virgularia*. The whole of the exhibits are from Port Jackson, and form interesting additions to our fauna.

The following "Note on *Danais Chrysippus* (L.), and *D. Petilia* (Stoll)," was read on behalf of Mr. W. H. Miskin of Brisbane:—

"In a note in the Proceedings of this Society for 1887 (p. 1076), Mr. George Masters offers some remarks upon these two (so-called) species, the conclusion of which appears to be that, in his opinion, they are distinct species and both occur in Australia. Mr. Masters in his article quotes me as 'boldly asserting that these insects are one and the same species.' I presume he refers to some observations of mine published in the Proceedings of the Entomological Society of London for 1874 (p. 244), wherein I certainly used the words attributed to me, but explained that in my opinion *Petilia* was the Australian form of *Chrysippus*, and gave some reasons for my belief. I still hold the same view, that is to say, that we have one form in Australia, varying to some slight extent in individuals, but tolerably constant in the peculiarities that seem to distinguish it from the typical species, which I will hereafter enumerate; and as our insect, to my mind, is almost exactly represented by Stoll's figure, and is sufficiently stable in its characters to entitle it to rank as a good local variety, the name *Petilia*, it is advisable, should be retained for it. I regret that I am unable to refer to Godart's description, the only one given of it. I have collected our insect along almost the entire Queensland eastern seaboard for the last twenty years in abundance, it being a tolerably common species, and have never seen an example that could be mistaken for the typical *Chrysippus*, or that could, as I have said before, fail to be identified with Stoll's figure. My acquaintance with *Chrysippus* is derived from examples of that species in my collection from Egypt, W. and S. Africa, Mauritius, and Ceylon; and I have before me figures and descriptions in Moore's 'Lep. of Ceylon,' Distant's 'Rhop. Malayana,' and Marshall and De Nicéville's 'Butterflies of India,' &c. I have also examined Cramer's figure. I distinguish *Petilia* from *Chrysippus* by the following peculiarities: the much paler hue of the ground-colour, wider black apical area of primaries extending quite to hinder angle and therefrom a short distance

along hinder margin, and darker costal border; in secondaries the *always* broad brown outer and hinder marginal band, and the constant absence of a sub-marginal row of white spots therein. All my specimens of *Chrysippus*, as well as the figures (and descriptions) referred to, present an insect, the ground-colour of which is of a much redder hue than in our form, the outer black marginal band of primaries never continued along the hinder margin—in fact barely reaching the angle; the secondaries with always a very narrow outer and hinder black marginal band, and a row of white spots within it. (In my Mauritius specimens the white spots are less distinct). In each case I refer to the upper side only; on the under side there is hardly any distinguishable difference in the two forms. I am very sorry that I had not the opportunity, when recently in Sydney, of seeing the specimens which have enabled Mr. Masters to form his conclusion; I am, however, bound from the facts I have before stated, viz., the absence from all the specimens that have come under my notice—some hundreds probably—of one that coincides with the true *Chrysippus*, and of their all agreeing well with Stoll's figure, to believe that Mr. Masters is mistaken in his opinion. I the more regret having to hold this belief as I observe, from some earlier notes in the Proceedings, that so distinguished an entomologist as Mr. W. Macleay had arrived at a similar conclusion with Mr. Masters." *

Mr. A. Sidney Olliff exhibited *Zopherosis Georgii*, a fine heteromerous beetle, of which he had recently found several specimens at Mt. Wilson, Blue Mountains.

On the motion of Mr. Trebeck votes of thanks were accorded to the Hon. William Macleay and to Dr. Cox for their valuable donations to the Library.

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* Mr. Miskin has evidently never seen *Danais Petilia*, Stoll, an insect very distinct from *Danais chrysippus* the common Queensland species. *D. Petilia* seems to be exclusively confined in its range to the North-western parts of Australia, and specimens of it can be seen at any time in the Macleay Museum.—(Ed.)

WEDNESDAY, 27TH FEBRUARY, 1889.

The Hon. William Macleay, F.L.S., in the Chair.

Mr. A. W. Fletcher, B.Sc., was introduced as a Visitor.

The Minutes of last Meeting were read and confirmed.

The Chairman announced that the next Excursion had been arranged for March 23rd, Members to leave Redfern Railway Station, for Clifton, Illawarra line, by the 9·10 a.m. train.

The following donations were announced :—

"A List of the Described Longicornia of Australia and Tasmania." By Francis P. Pascoe, F.L.S., &c. *From the Author.*

"Feuille des Jeunes Naturalistes." No. 219, (Jan. 1889). *From the Editor.*

"Monatliche Mittheilungen des Naturwissenschaftl. Vereins des Reg.-Bez. Frankfurt." Jahrg. VI., Nos. 1-6, (April to September, 1888); "Societatum Litterae." Jahrg. II., Nos. 5-8, (May to August, 1888). *From the Society.*

"Proceedings and Transactions of the Royal Society of Canada for the years 1885-87." (Vols. III-V) *From the Society.*

"Zoologischer Anzeiger." XI. Jahrg., No. 296, (1888). *From the Editor.*

"L'Académie Royale de Copenhague.—Bulletin pour 1888." No. 2. *From the Academy.*

"The Transactions of the Entomological Society of London for the year 1888." Part IV. *From the Society.*

"Proceedings of the Cambridge Philosophical Society." Vol. VI., Part 4, (1888). *From the Society.*

"The Journal of Conchology." Vol. V., No. 12, (1888). *From the Conchological Society of Great Britain and Ireland.*

"The Victorian Naturalist." Vol. V., No. 10 (February, 1889). *From the Field Naturalists' Club of Victoria.*

"Bulletin de la Société Zoologique de France pour l'année 1888. Tome XIII., No. 8. *From the Society.*

"Proceedings of the Canadian Institute, Toronto." 3rd Series, Vol. VI., Fasc. 1, (1888). *From the Institute.*

"The American Naturalist." Vol. XXII., Nos. 263 and 264, (Nov. and Dec., 1888). *From the Editors.*

"Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A." Vol. XVI., No. 2, (1888); "Annual Report of the Curator for 1887-88. *From the Curator.*

"Bulletin of the American Geographical Society." Vol. XX., No. 4, (1888). *From the Society.*

"The Proceedings of the Royal Society of Queensland, 1888." Vol. V., Part 5. *From the Society.*

"Proceedings of tho Royal Society of London." Vol. XLIV., Nos. 271 and 272, (1888). *From the Society.*

"Report on the Geology of the Russell River, Queensland." By R. L. Jack, Government Geologist. *From the Director, Geological Survey of Queensland.*

"Insecta Britannica.—Vol. III., (Lepidoptera: Tineina)." By H. T. Stainton. *From F. A. A. Skuse, Esq.*

"Abstract of Proceedings of the Zoological Society of London, 18th Dec., 1888." *From the Society.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 38, (Feb., 1889). *From the Editor.*

The following Journals, Magazines, &c., for 1888 as published: "The Athenæum;" "Annals and Magazine of Natural History;" "English Mechanic;" "Entomologist;" "Entomologists' Monthly Magazine;" "The Field;" "Geological Magazine;" "The Ibis;" "Journal of Anatomy and Physiology;" "Journal of Botany;" "Nature;" "Proceedings of the Royal Geographical Society;" "Quarterly Journal of Microscopical Science;" "Science Gossip;" "The Zoologist;" "The Scottish Geographical Magazine." *From the Hon. W. Macleay, F.L.S., &c.*

NOTES ON THE GENUS *LESTOPHONUS*, WILLISTON, AND DESCRIPTION OF A NEW SPECIES.

By Frederick A. A. Skuse.

Rather more than two years has elapsed since Mr. Frazer S. Crawford, of Adelaide, made the important discovery that a small Dipterous insect was parasitic upon, and destroyed, the adult females of the Coccid *Icerya Purchasi*, Mask., thus checking the overproduction of a species so notorious for its serious depredations on several important trees, especially of the orange kind, in certain other countries, but which is credited with being indigenous to Australia. Shortly subsequent to the detection of this parasite, the above-mentioned gentleman forwarded to Professor Riley of the United States Department of Agriculture (Div. of Entom.) at Washington, a few specimens (and drawings), together with one or two specimens of a fly of similar appearance, regarded as being specifically identical with the former, but which had been reared from the adult females of another distinct Coccid, *Monophlebus Crawfordi*, Mask.

For several years *Icerya Purchasi* has been committing extensive and costly ravages in California, so that American Entomologists naturally manifested considerable interest in the discovery of this deadly parasite. The specimens of the fly sent to Professor Riley were speedily submitted to Dr. Williston for examination; the opinion was expressed that the fly belonged to a new genus referable to the Oscinidæ, and the insect was eventually described under the name *Lestophonus iceryæ*, in the "Bulletin of the Entomological Dept.," (Washington) for July, 1888. Shortly afterwards an experienced Entomologist, Mr. A. Koebele, attached to the U.S. Department of Agriculture, visited Australia in order to

investigate *Icerya Purchasi* and its parasites, and during his stay in this country sent some thousands of specimens of infested *Icerya Purchasi* and *Monophlebus Crawfordi* to America in order to introduce their natural enemies into the agricultural districts of California plagued with the former.

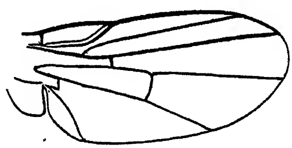
During the last few weeks I have bred large numbers of *Lestophonus* from both the *Icerya Purchasi* and *Monophlebus Crawfordi*, with the view to ascertain if the species be really identical or not, and having carefully and minutely examined these, and also other specimens kindly transmitted to me by Mr. Crawford, it appears clear that the accepted specific identity of the two has been founded on insufficient evidence. This might be accounted for by the meagreness of the material at the disposal of Dr. Williston when he described *L. iceryæ*, or from the possibility that amongst the three or four specimens before him only one represented the *Monophlebus* fly, while even had the author detected a slight difference in an individual, as perhaps the parasites were not separated according to their respective hosts, the dissimilarity would not unlikely have been considered merely varietal; while on the other hand, as Mr. Crawford points out to me, it is not absolutely certain that Dr. Williston did receive both species for examination. It is not easy to say from the description which species the author really described, and were it not almost beyond doubt that it does refer to one of these two, it might otherwise be thought to possibly mean a different insect; the length given at the beginning of the description is, to start with, that of an insect only half the size of the female of the true *Icerya* parasite. Further, it is utterly out of the question to decide from the rough figure given of the fly, which indeed serves only to imperfectly set forth the generic characters, while the wing (the shape of which is inaccurate) exhibits a venation equally unrepresentative in detail of both flies. The legs are also very unlike those depicted.

Considering the number of specimens which have lately reached America it is not unreasonable to expect that the *Monophlebus*

parasite has been separated from the other and characterised; but with a view of assisting in the exact determination, I now describe it under the name *Lestophonus monophlebi*, and in addition make the original description of *L. iceryæ* more complete.

Lestophonus iceryæ, Williston.

♂.—Long. 0·050 inch, 1·27 mm. ♀.—Long. 0·080 inch, 2·02 mm. Antennæ black, the large terminal joint squarish at the apex, with a microscopic spine before the apex above. Eyes reddish-brown, rather longer and narrower than in *L. monophlebi*. Ocelli disposed in a rather narrower triangle than in *L. monophlebi*. Face, front, thorax and scutellum deep blue, subnitidous. Abdomen deep shining green, punctulate. Coxæ, femora, and tibiæ dark brown, or blackish-brown; all the tarsi brownish-yellow. Wings greyish-hyaline, the veins dark brown. Course of the auxiliary vein indicated by a very pale line running close to the first longitudinal; reaching the costa; slightly yellowish at the base. First longitudinal vein more or less angular at the bend. Middle transverse vein situated a little before the tip of the first longitudinal and much nearer to the origin of the second longitudinal than to the hinder transverse vein. Ultimate section of the fifth longitudinal vein more than twice the length of the hinder transverse vein.

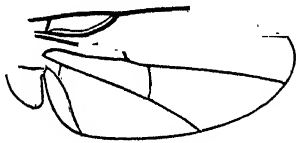


Bred from *Icerya Purchasi*, Mask., in February.

Lestophonus monophlebi, sp.n.

♀.—Long. 0·070 inch, 1·77 mm. Antennæ black, the large terminal joint rounded at the apex, with a microscopic tubercle before the apex above. Eyes reddish-brown, shorter and broader than in *L. iceryæ*. Face, front, thorax and scutellum deep blue, levigate. Abdomen generally deep shining purplish-black, indistinctly punctulate. Coxæ, femora and tibiæ very deep blue; all

the tarsi brownish-yellow. Wings greyish-hyaline, the veins brown, with the fourth and fifth longitudinal veins much paler from the hinder transverse vein to the posterior margin. Auxiliary vein brownish-yellow, indistinct, close to the first longitudinal, determinable as far as opposite to, or a little past, the origin of the second longitudinal, continuing from thence to the costa as a very pale line. First longitudinal always rounded at the bend. Middle transverse vein situated somewhat beyond the tip of the first longitudinal vein and nearer to the hinder transverse vein than to the origin of the second longitudinal. Hinder transverse vein forming with the fifth longitudinal an angle less than a right angle. Ultimate section of the fifth longitudinal vein not twice the length of the hinder transverse vein.



Bred from *Monophlebus Crawfordi*, Mask., in February.

Obs.—A small specimen (long. 0·042 inch, 1·06 mm.) which seems to me to be a male, has the middle transverse vein mid-way between the origin of the second longitudinal vein and the hinder transverse vein.

If this genus is to be placed in the Oscinidæ, it appears to me that it must occupy that position as a somewhat anomalous genus. Not only is the arista to the antennæ entirely wanting and the anal cell present, but I can also detect a rudimentary auxiliary vein and a pale posterior basal transverse vein. As in certain other genera of the Oscinidæ, these flies have the posterior tibiæ a little curved.

Note.—I have recently seen "Insect Life" for Jan., 1889, issued by the U.S. Dept. Ag. in which a correspondent states that he is glad the identity of the parasite (*Lestophonus*) found on *Monophlebus* and *Icerya* is considered proved beyond a doubt, but surely this decidedly erroneous conclusion cannot have been arrived at by an examination of the insects.

DESCRIPTIONS OF TWO NEW SPECIES OF AUSTRALIAN CETONIIDÆ.

By Oliver E. Janson, F.E.S.

(Communicated by A. Sidney Olliff, F.E.S.)

Diaphonia olliffiana, n.sp.

♂.—Above pale yellow, shining; base of the head black, the yellow extending posteriorly in the centre to a point, two very small spots near the apex of the clypeus black; antennæ red-brown, the basal joint black; thorax with a large broad ʍ-formed discoidal mark, a small spot on each side and a narrow border at the base and apex black; scutellum margined with black at the sides; elytra with five large black spots on each, the first on the humeral callus, the second adjoining the scutellum, the third and fourth placed transversely just behind the middle, and the fifth on the apical callus; pygidium with a large central and two smaller spots at the base, a spot on each side in the middle, and a sinuous marginal mark on the underpart black. Beneath black, shining; centre of the mentum, sides of the prothorax, front of the anterior coxæ, outer parts of the meso- and metathoracic epimera and posterior coxæ, sides and front of the metasternum, apex of the intermediate coxæ, a spot on the posterior coxal plates, and a broad stripe in the centre, and a spot on each side of the abdominal segments pale yellow. Legs reddish-yellow, the trochanters, knees, ends of the tibiæ and tarsal joints, and the claws piceous.

Head sparsely punctured at the base, coarsely and more closely punctured in front, sides of the clypeus rounded and narrowed in front, the apex emarginate in the centre, the apical angles obtuse and somewhat reflexed; club of the antennæ a little longer than

the head. Thorax slightly rounded at the sides, the base trisinuous with the lateral angles obtuse and slightly prominent, very finely and sparsely punctured on the disk, coarsely punctured at the sides. Scutellum smooth, the apex produced and acute, the sides impressed. Elytra impressed in the region of the scutellum, sparsely punctured near the suture, the sides with very coarse confluent transverse striæ. Pygidium concentrically strigose. Underside closely punctured and with long grey pubescence at the sides; mesothoracic epimera smooth on the upperside; metasternum longitudinally impressed in the centre, the mesosternal process broad and rounded at the apex; abdomen slightly impressed in the centre, apical margin of the penultimate segment punctured and fringed with long grey hairs. Legs punctured and pubescent, anterior tibiæ with a small lateral tooth about one-third from the apex. Length 24 mm.

Warra, New South Wales (Capt. W. Peel).

Apart from the great difference in coloration this species is extremely like *D. dorsalis*, Don.; the punctuation however is altogether more sparse, the base of the thorax is more broadly and less deeply emarginate before the scutellum, the sutural interstice of the elytra is narrower towards the base, and there is a small but distinct lateral tooth on the anterior tibiæ.

I am indebted to my friend Mr. A. Sidney Olliff for a male specimen of this fine species. The female is unknown to me.*

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* In communicating Mr. Janson's Paper to the Society I venture to add the characters of the female of this species, of which sex a single and greatly damaged example is in the collection of the Australian Museum. It is 28 mm. in length, and has the markings disposed as described above, although they would appear to be more widely separated, and therefore more conspicuous; the punctuation on the prothorax is coarser; the sides of the elytra are only sparingly provided with transverse striæ; and the basal joint of the antennæ is reddish-yellow. In the male the elytral markings occasionally coalesce, and judging from the half-dozen specimens I have seen, display considerable variation in form and size.—*A. Sidney Olliff.*

DIAPHONIA ADUSTA, n.sp.

♂.—Sub-quadrate, moderately convex, shining black; elytra red-brown at the sides, piceous or black towards the suture and apex; a broad marginal border at the sides of the thorax, the pygidium and a spot on the outer sides of the mesothoracic epimera, and the posterior coxæ and abdominal segments yellow; antennæ and palpi red-brown; tarsi piceous.

Head rather coarsely but not very closely punctured in front, more finely punctured behind; clypeus sub-quadrate, a little widened and slightly rounded in front, the margins thick and strongly reflexed, the reflexed apical margin slightly emarginate in the centre; club of the antennæ nearly as long as the head. Thorax rounded at the sides, feebly tri-sinuous at the base, the basal angles scarcely rounded, almost impunctate on the disk, finely and somewhat diffusely punctured at the sides and base. Scutellum triangular, almost impunctate, the sides impressed Elytra with two rows of coarse punctures near the suture, the interstice with scattered punctures, the lateral and apical parts somewhat dull and closely covered with irregular confluent punctures and striæ, the inner discal costa rather prominent towards the apex, the outer one almost obsolete. Pygidium sparsely punctured. Underside punctured and with very sparse grey pubescence at the sides; metasternum deeply impressed in the centre; mesosternal process narrowed and obtuse at the apex; abdomen smooth and with a slight longitudinal impression in the centre. Legs punctured and with sparse long hairs, all the tibiæ with a large acute submedian tooth, apex of the anterior tibiæ strongly produced on the outer side. Length 12-13 mm.

Western Australia.

This species is closely allied to *rugosa*, Schm., but differs in having the margins of the clypeus more strongly reflexed, the thorax almost impunctate on the disk and more finely punctured at the sides, the scutellum, inner part of the elytra and the

pygidium more sparsely punctured, and the mesosternal process narrower at the apex; the elytra are also of a lighter colour at the sides, and the head, underside, and legs are black. From *maura*, Jans., it may be at once distinguished by its different coloration, broader and more quadrate form, and much larger antennal club.

I possess two males of this species but am not aware of the precise locality in which they were found; the other sex is unknown to me.

D. rugosa, Schm., is included by Dr. Kraatz in his genus *Metallesthes* but does not at all agree with the characters given of that or of any of the other numerous so-called genera as characterised by that author in his "Genera Cetonidarum Australiæ." (LONDON: January 15th, 1889).

NOTES AND EXHIBITS.

Mr. Brazier exhibited, on behalf of Mr. R. C. Rossiter, a pair of the eggs of the "Mallow Hen" *(Megapodius Layardi)* from Malicolo, New Hebrides.

Mr. Fletcher read a letter from Baron von Mueller invoking the aid of members of the Society in obtaining information bearing upon the exact geographical distribution of the Waratah (*Telopea speciosissima*), the altitudes to which it ascends mountains, the stature it attains, &c.

Mr. Skuse exhibited specimens of a Tineid bred from seed-capsules of *Phyllanthus Ferdinandi* found at Manly about a month ago; also specimens of a minute Hymenopterous insect (*Chalcididæ*) parasitic on the former. The larvæ of the moth feed on the seeds, and the imagines emerge as soon as the ripe capsules split, though even while these are green frequently a perfect moth may be released from each of the five seed-chambers.

Mr. Skuse also showed examples of the two Coccids with their respective dipterous parasites mentioned in his paper.

Mr. Rohu exhibited four embryos of *Crocodilus porosus* in rather advanced stages of development, from Queensland. Also portions of the stem of an undetermined plant,* probably a creeper, from the Clarence, shewing remarkable ridge-like, corky outgrowths.

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* Subsequently ascertained to be *Mezoneurum brachycarpum*, Benth.; (*vide* 'Notes and Exhibits' for April, 1889).

WEDNESDAY 27TH MARCH, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

Mr. A. Burnell was present as a visitor.

Mr. A. W. Fletcher, B.A., B.Sc., was elected a Member of the Society.

The President announced that the next Excursion had been arranged for Saturday April 27th, Members to leave Redfern Station by the 9·25 a.m. train for Brooklyn, Hawkesbury River.

The following donations were announced :—

"Transactions of the Royal Society of Edinburgh." Vols. VIII., XXI. (Part 4), XXII. (Parts 1 & 3), XXIII., XXIV., XXVI. (Part 4), XXVIII. (Parts 2 & 3), XXIX., (1817-80); "Transactions of the Royal Irish Academy." Vols. I.-X., XVI., XVII., XVIII. (Part 1), XIX., XXI. (Part 1), (1787-1846); "Charter and Statutes;" "Index, 1786-1813:" "Mémoires de la Société de Physique et d'Histoire Naturelle de Genève." Tomes I.-XXII. (1821-73) ; "Premier Supplément au Tome XII. ;" "Table des Mémoires, &c., T. I.-XX. :" "Proceedings of the Boston Society

of Natural History." Vols. I.-XII. (1844-69); "Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft, Frankfurt a/M." Band I.-XII. (1854-81); "Annales des Sciences Géologiques." T. I.-XX. (Parts 1 and 2) (1869-88); "Annales des Sciences Naturelles—Zoologie." 6e Série. T. XV., XVI., XIX., XX. (1883-85); "Botanique." 6e Série. T. XVII.-XX. (1884-85); "Challenger Reports.—Zoology." Vols. XXVIII. and XXIX.; "Archives de Zoologie Expérimentale et Générale." 2e Série. Tomes IV. et V. (1886-87); "Zeitschrift für wissenschaftliche Zoologie. XLVII. Band, 3 Heft (1888); "Namen-und Sachregister über Band XXXI.-XLV." "Notes from the Leyden Museum." Vol. X., No. 4 (1888); "The Geological Magazine." Vols. VIII.-X. (1871-73); New Series (Decade II). Vols. VII. and VIII. (1888-81); "Coloured Figures of English Fungi or Mushrooms." By James Sowerby, F.L.S. 3 vols. and Supplement (1797-1803); "Curtis's Botanical Magazine." 3rd Series. Vol. XLIV. (1888); "Stettiner Entomologische Zeitung." 49 Jahrg. (1888). *From the Hon. William Macleay, F.L.S.*

"United States National Museum.—Bulletin." Nos. 4, 7, 8, 11, 13-24, 27-31 (1876-86); "Proceedings." Vols. I.-IX. (1878-86), Vol. XI. (sheets 9-11); "International Exhibition, 1876—Classification of the Collection to illustrate the Animal Resources of the United States." By G. Brown Goode, M.A. *From the Museum.*

"Bijdragen tot de Dierkunde." 14e-16e Aflevering (1887-88); Feest-Nummer (1888). *De la part de la Société Royale de Zoologie, Natura Artis Magistra, Amsterdam.*

"Proceedings of the American Academy of Arts and Sciences." n.s. Vol. XV., Part 1 (1888). *From the Academy.*

"Nova Acta der Ksl. Leop.-Carol. Deutschen Akademie der Naturforscher." Band L., No. 6; LI., Nos. 2, 5, and 6 (1886-87): "Leopoldina." 22 and 23 Heft (1886-87). *From the Academy.*

"Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien." Jahrg. 1888, XXXVIII. Band, Parts 1 and 2. *From the Society.*

"Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg." VII^e Série. Tome XXXVI., Nos. 1 and 2 (1888); "Bulletin." T. XXXII., No. 2 (1888). *From the Academy.*

"Mittheilungen der Naturforschenden Gesellschaft in Bern aus dem Jahre 1887." *From the Society.*

"Annales de la Société Entomologique de Belgique." Tome XXXI. (1887). *From the Society.*

"The Journal of the Cincinnati Society of Natural History." Vol. XI., No. 1 (1888). *From the Society.*

"The American Museum of Natural History.—Annual Report of the Trustees, &c., for the year 1887-88." *From the Museum.*

"Descriptive Catalogue of the Sponges in the Australian Museum, Sydney." By Robert von Lendenfeld, Ph.D., F.L.S.; "Tabular List of Australian Birds, &c." By E. P. Ramsay, LL.D., F.R.S.E., &c. *From the Trustees of the Australian Museum.*

"Systematic Account of the Geology of Tasmania." By Robert M. Johnston, F.L.S., &c. *From the Premier of Tasmania.*

"Abstract of the Proceedings of the Zoological Society of London, 15th Jan., 1889. *From the Society.*

"Department of Mines, Sydney.—Records of the Geological Survey of New South Wales." Vol. I., Part 1 (1889). *From the Minister for Mines.*

"Feuille des Jeunes Naturalistes." No. 220 (Feb. 1889). *From the Editor.*

"The Canadian Record of Science." Vol. III., No. 5 (1889). *From the Natural History Society of Montreal.*

"Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A." Vol. XVI., No. 3 (1888). *From the Curator.*

"The Journal of the Bombay Natural History Society." Vol. III., No. 4 (1888). *From the Society.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 297-299 (1888). *From the Editor.*

"The Journal of Comparative Medicine and Surgery." Vol. X., No. 1 (1889). *From the Editor.*

"The Victorian Naturalist." Vol. V., No. 11 (March, 1889). *From the Field Naturalists' Club of Victoria.*

"Centennial International Exhibition, Melbourne, 1888.—Catalogue of the Exhibits in the New South Wales Court." *From the New South Wales Commission.*

"Annales du Musée d'Histoire Naturelle de Marseille.—Zoologie." Tome II. (1885). *From the Museum.*

"Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia." 3rd Session (1887-88). Vol. III., Part 2. *From the Society.*

"The Transactions of the Entomological Society of London for the year 1888." Part v. *From the Society.*

"Report on the Coal Discoveries on the Flinders;" "Second Report on the Mount Morgan Gold Deposits." By Robert L. Jack, Government Geologist, Queensland. *From the Director, Geological Survey of Queensland.*

"Australian Butterflies: A Brief Account of the Native Families, &c." By A. Sidney Olliff, F.E.S. *From the Author.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 39 (March, 1889). *From the Editor.*

"Records of the Geological Survey of India." Vol. XXI., Part 4 (1888). *From the Director.*

REVISION OF THE GENUS *HETERONYX*, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem. Linn. Soc. N.S.W.

Part II.

The species of *Heteronyx* to be dealt with in this second part of my memoir form a group distinguished from the other groups of *Heteronyx* by the possession of the following characters in combination, viz.,—upper margin of labrum rising above the plane of the clypeus, antennæ 8-jointed, claws appendiculate. No species previously described have had all these characters definitely attributed to them by their authors, although several (in all probability) possess them. *H. unicolor*, Blanch., is doubtful only in respect of its labrum (the author merely specifying that its labrum is visible from above, whence it might belong either to this group or to the group of what I have called intermediate forms); there are independent objections however to identifying with it any of the species before me. *H. (Silopa) glabrata*, Er., *fumata*, Er., and *nigella*, Er., are all described by their author as having 9-jointed antennæ and bifid claws, but M. Lacordaire has since asserted that their antennæ consist of eight joints only, and that the claws of *nigella* are appendiculate; if this be correct, *nigella* at least would fall into the group treated of in this present article, and (as will appear below) I have identified with it an insect sent to me from Tasmania (Erichson's locality for all the three just named) by Mr. Sloane and the Hon. W. Macleay, the latter of whom had attached the name to it. *Glabrata* is a glabrous species of more than average size, while *fumata* is described as having the prothorax not narrowed in

front, and the head rather obsoletely punctured; no species before me seems to agree with either in these respects. Of Burmeister's species *H. nigricans* and *spadicea* in all probability come in here; but the absence of any exact description of the labrum and of any mention of the claws renders it impossible to be quite certain; they are both from W. Australia, a locality from which I have only seen a single species of *Heteronyx* of this section; it agrees fairly well with the description, such as it is, of *H. nigricans* with which I have consequently considered it identified. *H. spadicea*, Burm., (assuming its place in this section) might not improbably resemble *H. Augustæ*, mihi; but the description is so vague—giving no information for example as to the relative size of the metasternum and hind coxæ—that it is scarcely possible to make a *guess*, unless one happened to have before one a specimen agreeing with the brief description, and taken in W. Australia, as in the case of the specimen I have regarded as being *H. nigricans*. With the exception of Mr. Macleay's species the above are all of those previously described whose recorded characters would not exclude them from this section. Mr. Macleay's descriptions of *Heteronyx* have unfortunately in general omitted the mention of such characters as the number of joints in the antennæ, the structure of the claws, &c., &c. The Hon. gentleman has, with the utmost courtesy, lent me types of as many of these as possible; but there still remain the following, viz., *H. concolor*, *infuscatus*, *pallidulus*, *pubescens*, *ruficollis*, *substriatus*, *parvulus* (all from Queensland), and *transversicollis*, *subglaber*, *subvittatus* (all from N.W. Australia), which there is no possible course but to disregard altogether until such time as specimens taken in Queensland or N.W. Australia, and agreeing with the descriptions, shall furnish some tangible ground for identification. As none of the new species here described as belonging to this section are from either of these localities, it is, however, improbable that any are identical with any of Mr. Macleay's species.

The task of characterising the species before me (possessing the combination of characters mentioned above) in such manner that

they may be identified with some ease and confidence has proved no easy one. I think, however, that I have succeeded in specifying characters which will at least prevent the confusion *inter se* of any of those dealt with in this memoir; but in order to do so I have had to avail myself of characters that require some preliminary observations.

I find that not a few species of *Heteronyx* are distinguished from their nearest allies by little that is tangible except differences in puncturation, and in the relations to each other of the labrum and clypeus. Though these distinctions are abundantly satisfactory as separating the species, they are nevertheless of *degree* and difficult to render available to the reader of a memoir. The former of them I attempt to indicate (as regards the prothorax) by specifying that "closely" punctulate means in the tabulation having the punctures so placed that twenty or more might run down the middle of the disc if they were placed in a longitudinal line and at about what is actually their average distance one from another. The relation of the labrum to the clypeus (*i.e.*, the extent transverse and vertical of the portion of the former overtopping the plane of the latter, and the convexity of the curve of the former) seems to be a very important and reliable character for distinguishing one species from another, but it is extremely difficult to express in definite terms. After much consideration I have adopted a method of expression that I now proceed to explain. If a specimen of *Heteronyx* belonging to this section be viewed from above it will be found that there is a certain point of view (a point perpendicularly above the suture of the elytra, from which the eye looks more or less obliquely forward along the surface of the insect) whence the outline of the front of the head, from eye to eye, appears as a continuous trisinuate or trilobed curve. The nature of this curve depends entirely upon the relation of the labrum to the clypeus, and therefore seems fitted to serve as an index of that relation; I find it very constant in individuals of the same species. In the following descriptions this curve when spoken of is called the "trilobed outline" of the head. In species whose clypeus is deeply and widely emarginate,

while the labrum is strongly narrowed upward (e.g. *H. nasutus*, mihi), this structure is very conspicuous; while in some whose clypeus is but little emarginate, while the labrum is feebly curved above and feebly elevated (e.g. *H. debilis*, mihi), the outline of the head from the most favourable point of view,—which is a point whence the sight is almost parallel to the surface of the head,—is a curve in which the sinuations are little noticeable. In order to compare the lobes of this "trilobed outline" in definite terms, I call the length of a straight line joining the extremities of the free outline of each lobe the "width" of that lobe, and by the "length" of the lobe I mean the distance that it projects outward from that line.

To minimise words in the following descriptions I call the fringe of stout hairs running along the sides of the elytra "normal," when it is not continued in any markedly conspicuous manner round the apex.

It should also be noted that whenever the "length" of the metasternum is referred to, its length is to be measured along the suture between it and its episternum.

The hind angles of the prothorax as seen from above are in many cases not the real angles formed by the meeting of the lateral and posterior reflexed margins, and consequently they present different appearances from different points of view. To meet this difficulty I have in every case described the hind angles of the prothorax as they appear from directly above the middle longitudinal line of the insect, selecting in the line thus indicated the point from which the angles appear most strongly defined.

Tabulation of the groups of *Heteronyx* thus far dealt with, inclusive of those in the present memoir:—

Section I.—Clypeus altogether above the summit of the labrum (as in most other Melolonthidæ). *Vide* P.L.S. N.S.W. (2) III., p. 1328.

Section II.—Intermediate forms,—in which the labrum is turned upward, and nearly or quite rises to the level of the plane of the clypeus, but does not overtop it (*l.c.* p. 1353).

Section III.—Labrum turned upward and overtopping the plane of the clypeus. (By far the largest Section,—subdivided as follows) :—

Group 1.—Antennæ 8-jointed.

Subgroup 1.—Claws bifid. (*l.c.* p. 1359).

Subgroup 2.—Claws appendiculate. (The subject of the present memoir.)

Group 2.—Antennæ 9-jointed. (To be dealt with in next memoir.)

Tabulation of the species dealt with in the present memoir :—

A. Hind coxæ at their longest not (or scarcely*) shorter than the suture between the metasternum and its episterna.

B. Elytra furnished with fine short adpressed pubescence.

C. Elytra not granuliferous.

D. Puncturation of hind coxæ rather close on external half of the surface (size large)...... *normalis*, Blackb.

DD. Puncturation of hind coxæ at its closest only very sparing (size very small)............... *brevicornis*, Blackb.

CC. Elytra granuliferous................. *granulifer*, Blackb.

BB. Elytra bearing only long isolated more or less erect hairs (as in *H. fulvohirtus*, Blackb.) .... *nasutus*, Blackb.

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*I have added this saving clause,—but I find that in the 4 species actually included under this heading the metasternum is in no case *noticeably* longer than the hind coxæ, although measurement in two of them proves that it is very slightly so.

AA. Hind coxæ distinctly shorter than the suture between the metasternum and its episterna. ....

B. Hind coxæ distinctly longer than external margin of 2nd ventral segment.........................,.........

C. Puncturation of elytra very close and more or less confluent (as in *H. piceus*, Blanch., *horridus* and *normalis*, Blackb., &c. ....

D. Puncturation of elytra smooth and very minute.................

E. Lateral margins of clypeus convergent (hindward) close to the eye......................... *Mulwalensis*, Blackb.

EE. Lateral margins of clypeus divergent (hindward) quite to the eye .... *punctipennis*, Blackb.

DD. Puncturation of elytra coarser and subrugulose .... *nigricans*, Burm.

CC. Puncturation of elytra less close and more isolated (as is usual in the genus).....................

D. Labrum uniformly rugulose. ...

E. Prothorax fully twice as wide as long........................... *piger*, Blackb.

EE. Prothorax less than twice as wide as long................. *raucinasus*, Blackb.

DD. Labrum not uniformly rugulose.............................

E. Prothorax closely punctulate [intervals between punctures $\frac{1}{20}$ (or less) the length of the segment.] ....

F. General puncturation more or less coarse, and not uniform over upper surface ....

G. Club of antennæ black... *nigellus*, Er.

GG. Club of antennæ yellow *dubius*, Blackb.

FF. Puncturation fine and uniform (though not minute and confluent as in *punctipennis*, &c.) Size over 5 lines .... *constans*, Blackb.

EE. Prothorax more sparingly punctulate. ....

F. Prothorax only moderately narrowed forward (base not more than ½ again as wide as front) ....

G. Middle lobe of "trilobed outline" of head at least half as wide as lateral lobes ....

H. Lateral margins of clypeus nearly straight...... *electus*, Blackb.

HH. Lateral margins of clypeus normally curved.............. *cygneus*, Blackb.

GG. Middle lobe of "trilobed outline" of head appearing evidently less than half as wide as lateral lobes .... *auricomus*, Blackb.

FF. Prothorax more strongly narrowed forward (base more than ½ again as wide as front). ....

G. Ventral segments closely covered in the middle with strongly defined fine puncturation .... *anceps*, Blackb.

GG. Ventral segments in the middle at most feebly and not closely punctured ....

H. Hind angles of prothorax quite rounded off ....

I. General puncturation of upper surface exceptionally coarse and strong .... *crassus*, Blackb.

II. Puncturation of prothorax fine, of elytra moderate ... *Augustæ*, Blackb.

HH. Hind angles of prothorax from a certain point of view well defined .... *Sloanei*, Blackb.

BB. Hind coxæ not longer than external margin of 2nd ventral segment...

C. "Trilobed outline" of head not well developed; middle lobe much more than ½ as wide as lateral ones......................

D. Hind angles of prothorax from some point of view appearing acute or sharply rectangular...

E. Clypeal suture strongly elevated .... *dentipes*, Blackb.

EE. Clypeal suture obscure ...... *debilis*, Blackb.

DD. Hind angles of prothorax quite obtuse or rounded off......... *jejunus*, Blackb.

CC. "Trilobed outline" of head well-developed; middle lobe scarcely half as wide as lateral ones.................... *lateritius*, Blackb.

HETERONYX NORMALIS, sp.nov.

Minus elongatus; sat convexus; pone medium leviter dilatatus; minus nitidus; piceus vel ferrugineus; pilis pallidis brevibus adpressis (nonnullis longioribus erectis intermixtis) vestitus; subæqualiter crebre subtilius punctulatus; labro clypeum late sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. 4-5½, lat. 2-3 lines.

Labrum decidedly overtopping level of clypeus which is widely and roundly emarginate in front; "trilobed outline" of head having the lobes feebly convex, the middle one not very much narrower than the others; clypeal suture well defined, straight and impressed; head (especially the clypeus) a little more strongly sculptured than the rest of the body. Prothorax nearly twice as wide as long, and nearly twice as wide at base as at front which is strongly concave, with sharp well-produced angles; the sides are gently arched converging slightly from base to middle, thence more strongly; the hind angles viewed from above appear fairly well defined but not sharp nor directed hindward; the base is bisinuate and widely lobed in the middle. The elytra have more or less appearance of striation (in one example before me it is quite well marked); their transverse wrinkling is fine but distinct (especially in front); the lateral fringes are not carried round the apex, which is truncate with a narrow but distinct membranous border. The puncturation of the whole upper surface is fine, close, and even, with a tendency to become fainter and less close from the clypeus hindward, till on the pygidium (which is subgranulate) it is feeble and hardly close; it resembles that of *H. insignis*, Blackb. The metasternum and hind coxæ are of equal

length and are rather finely and closely pnnctured externally; the metasternum a little more sparingly towards the middle, where the hind coxæ are almost impunctate. The ventral segments are punctured almost as the metasternum. The ventral series consist of stout hairs and are well defined. The hind femora are decidedly wider than the intermediate, their inner apical angle very obtuse and scarcely prominent. The uppermost tooth on the anterior tibiæ is small but sharp.

S. Australia; widely distributed; also Kangaroo Island.

H. GRANULIFER, sp.nov.

Sat elongatus; minus convexus; pone medium vix dilatatus; sat nitidus; ferrugineus; pilis pallidis brevibus adpressis (non nullis perlongis, e granulis squamosis orientibus, intermixtis) vestitus; capite et elytris crebrius sat crasse, prothorace et pygidio sparsius subtilius, punctulatis; labro clypeum minus late minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. $4\frac{4}{5}$, lat. $2\frac{3}{5}$ lines (vix).

Labrum decidedly overtopping level of clypeus which is gently emarginate in front; "trilobed outline" of head having the lobes feebly convex, the middle one about half as wide as the others; clypeal suture fairly defined, straight, and impressed, clypeus forming an even surface with the rest of the head. Prothorax nearly twice as wide as long down the middle and more than half as wide again at base as at front which is moderately concave with sharp moderately produced angles; the sides are evenly and gently arched, most divergent immediately in front of the base; the hind angles viewed from above appear very ill-defined but not quite rounded off; the base is bisinuate, widely and feebly lobed in the middle; the elytra (in the example before me) have no trace whatever of striation; their transverse wrinkling is coarse and rather conspicuous; the lateral fringe is much abraded in the example before me but evidently is not in a fresh specimen carried round the apex in any conspicuous manner; the apex has an obscure membranous border. The puncturation of the whole

upper surface except the pygidium is very much coarser and less close than in *H. normalis.* The hind coxæ are scarcely so long (by measurement) as the suture between the metasternum and its episterna ; the metasternum is closely and rather finely punctured externally, less closely and more coarsely towards the middle ; the hind coxæ are punctured a little more strongly and less closely than the metasternum externally but are almost impunctate in their inner half. The basal ventral segment is punctured sparingly and moderately strongly on the sides, sparingly and faintly in the middle ; the other ventral segments are successively more and more feebly punctulate. The ventral series consist of stout hairs rising from granules and are very well defined. The hind femora are considerably wider than the intermediate, their inner apical angle well produced but rather obtuse. The uppermost tooth on the anterior tibiæ is strong (about half as large as the intermediate) and moderately sharp.

Roseworthy, S.A.

H. NASUTUS, sp.nov.

Sat elongatus; sat convexus ; pone medium minus dilatatus ; sat nitidus ; ferrugineus ; pilis flavis elongatis sat sparsim vestitus ; corpore supra crasse sat sparsim (capite minus sparsim, elytris apice pygidioque subtiliter) punctulatis ; labro clypeum anguste sat fortiter superanti ; antennis 8-articulatis ; unguiculis appendiculatis. [Long. $4\frac{2}{5}$, lat. $2\frac{1}{5}$ lines.

Clypeus with strongly and widely reflexed margins, strongly emarginate in middle ; "trilobed outline" of head having the lobes very strong, the middle one barely a third as wide as either of the others, about equal to them in length ; clypeal suture well defined, impressed, and strongly angulated in the middle, clypeus not forming an evenly continuous plane with the rest of the head. Prothorax about twice as wide as long down the middle and scarcely a third again as wide at base as at front which is moderately concave with sharp moderately produced angles ; the sides converging in a slight curve from base to front ; the hind angles viewed

from above appear fairly defined and obtuse; the base is feebly bisinuate, widely and feebly lobed in the middle. Elytra (of the example before me) without trace of striation, their transverse wrinkling coarse and fairly conspicuous; lateral fringe normal, apex with well defined membranous border. The puncturation is much coarser and stronger than in *H. granulifer*, and on the whole upper surface much resembles that of *H. fulvohirtus* (Sect. I.) Hind coxæ scarcely so long as the metasternum which is strongly punctured,—closely at the sides, sparingly in the middle,—the former being closely and strongly punctured throughout, and also finely coriaceous. The ventral segments are finely coriaceous, with tuberculous puncturation, which is strong and rather sparing at the sides,—nearly obsolete in the middle. The ventral series consist of moderately stout hairs and are fairly conspicuous. The hind femora are much wider than the intermediate and have their inner apical angle fairly prominent, but much rounded off. The anterior tibiæ are much like those of *H. granulifer.*

N. Territory of S. Australia.

H. BREVICORNIS, sp.nov.

Elongatus; sat convexus; pone medium vix dilatatus; minus nitidus; pallide fuscus vel ferrugineus; pilis subtilibus adpressis minus dense vestitus; capite crasse minus crebre (clypeo magis crebre), prothorace subtilius sat sparsim, elytris subtilius crebrius, pygidio sparsissime, punctulatis; labro clypeum late sat fortiter superanti; antennis 8-articulatis brevibus; unguiculis appendiculatis. [Long. $2\frac{1}{5}$-$2\frac{3}{5}$, lat. 1-$1\frac{1}{5}$ lines (vix.)

Clypeus almost truncate in front where there is no distinct reflexed margin; "trilobed outline" of head having the middle lobe quite as wide as the lateral ones and about equal to them in length, but (owing to forward protrusion of labrum) projecting forward beyond them; clypeal suture nearly straight, ill-defined; clypeus forming an almost evenly continuous surface with the rest of the head. Prothorax about half again as wide as long down

the middle, its base about half again as wide as its front which is lightly emarginate with very feebly produced angles; the sides diverge strongly from the apex to the middle where they are rounded and whence they converge slightly to the base with which their hind angles are almost rounded off; the base is scarcely distinctly bisinuate or lobed, but is almost evenly rounded all across. Elytra with no trace of striation except a fairly defined sutural stria; their transverse wrinkling scarcely perceptible; lateral fringe feeble and not continuous round apex which has a scarcely noticeable membranous border. The puncturation of the upper surface resembles that of *H. testaceus*, Blackb., (Sect. I.), but is feebler except on the head. Hind coxæ about as long as meta sternum, the puncturation of both being feeble and sparse (especially in the middle). The ventral segments are scarcely distinctly punctulate. The ventral series consist of long erect hairs and are very conspicuous, but obsolete in the middle. The hind femora are not very much wider than the intermediate and have their inner apical angle very feeble. The lower two teeth of the anterior tibiæ are very strong and sharp,—the uppermost tooth is obtuse and subobsolete.

S. Australia (Port Lincoln; also near Adelaide).

H. PUNCTIPENNIS, sp.nov.

Minus elongatus; latus; sat convexus; pone medium sat dilatatus; minus nitidus; obscure ferrugineus, antennis palpisque rufo-testaceis; pilis brevibus adpressis vestitus; clypeo creberrime rugulose, capite postice sat fortiter minus crebre, prothorace minus fortiter sat crebre, elytris crebre subtiliter squamose, pygidio fortius crebrius, punctulatis; tibiarum anticarum dentibus externis inferioribus perlongis; labro clypeum late minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis.

[Long. 4, lat. $2\frac{1}{5}$ lines.

Clypeus gently emarginate in front, its reflexed margin obsolete in the middle part; "trilobed outline" of head as in *H. debilis*

except that the middle lobe appears proportionally narrower owing to the greater convexity of the upper outline of the labrum; clypeus almost forming an even surface with the rest of the head; clypeal suture slightly wavy and not well marked. Prothorax very nearly twice as wide as long down the middle, its base more than half again as wide as its front which is only gently emarginate, with angles but little produced; its sides diverge in a slight curve from the apex to the base with which they form angles that from a certain point above appear quite sharp, and somewhat directed hindward; the base rather feebly bisinuate and moderately lobed in the middle. Elytra with little or no indication of striæ, their transverse wrinkling very fine, but from some points of view fairly distinct, their lateral fringes normal, their membranous apex well defined. The puncturation of the prothorax is evidently coarser, and that of the elytra evidently more minute, than in *H. normalis.* The hind femora are moderately wider than the intermediate, with their inner apical angle feeble and rounded. The hind coxæ are considerably shorter than the metasternum and evidently longer than the second ventral segment. The metasternum and hind coxæ are rather strongly and closely punctulate at the sides, the puncturation continuing more markedly than in most species across the middle, the latter having a smooth portion only towards the antero-internal corner. The hind body is punctured a little less strongly, the punctures being much enfeebled in the middle. The ventral series consist of fine hairs and are not very conspicuous. On the anterior tibiæ the lower teeth are long and sharp, but the uppermost is very small, evidently less than half the second.

Adelaide district.

H. Mulwalensis, sp.nov.

Sat elongatus; postice vix dilatatus; sat convexus; ferrugineus, antennis palpisque testaceis; pilis adpressis vestitus; capite toto creberrime æqualiter rugulose, elytris crebre subtiliter, pygidio sparsius sat subtiliter, punctulatis; tibiarum anticarum dentibus

externis inferioribus validis; labro clypeum late sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis.

[Long. $4\frac{4}{5}$-$5\frac{1}{5}$, lat. $2\frac{3}{10}$-$2\frac{2}{5}$ lines.

Closely allied to *H. punctipennis*, the description of which may be taken as applying to it except in so far as here modified. The "trilobed outline" of the head is much more conspicuous owing to the greater prominence of the labrum, the middle lobe appearing slightly narrower in proportion (*i.e.*, very little more than half as wide as the lateral ones); the plane of the clypeus is rather more distinct from that of the rest of the head and its lateral margins are more dilated, their outline being moreover angularly contracted at its base close in front of the eye (instead of forming an even gentle curve from the eye to the front); the entire head is very finely, closely, evenly and rugosely punctulate instead of having (as *H. punctipennis* has) the portion behind the clypeal suture very much more sparingly punctulate than the clypeus. The prothorax is slightly less wide in proportion to its length. The surface of the front face of the labrum is roughened and granulose, while in *punctipennis* it is smooth, nitid, and finely punctulate.

Mulwala, N.S.W.; taken by Mr. T. G. Sloane.

H. NIGRICANS, Er.

Sat elongatus; sat convexus; postice vix dilatatus; sat nitidus; piceo-niger, antennis palpisque testaceis, tarsis rufescentibus; pilis brevibus albidis adpressis sat sparsim vestitus; supra fortius sat crebre æqualiter (pygidio sparsim excepto) punctulatus; tibiarum anticarum dentibus externis inferioribus robustis acutis; labro clypeum late minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. 4, lat. $2\frac{1}{5}$ lines (vix).

Clypeus scarcely emarginate in front, its reflexed margin very fine but continuous; "trilobed outline" of head fairly defined, the middle lobe appearing decidedly narrower than the lateral ones; clypeus not forming an even surface with the rest of the head;

clypeal suture well marked and gently arched. Prothorax decidedly less than twice as wide as it is long, its base about half again as wide as its front which is rather strongly emarginate and subbisinuate, with angles little advanced and not very pointed; its sides are gently arched but scarcely convergent from the middle to the base; the hind angles viewed from a certain point above appear fairly defined and a little directed hindward but not sharp; the base moderately bisinuate and moderately lobed in the middle. Elytra with some indication of striæ, their transverse wrinkling not conspicuous, their lateral fringes normal, their apical membrane fairly developed. The puncturation of the upper surface as a whole closely resembles that of *H. gracilipes*. The hind femora are moderately wider than the intermediate with their inner apical angle scarcely at all prominent. The hind coxæ are decidedly shorter than the metasternum but considerably longer than the second ventral segment. The metasternum is moderately coarsely punctured all across, the hind coxæ are punctured much like the metasternum but are lævigate on the inner anterior portion. The ventral segments and anterior tibiæ scarcely differ from those of *H. punctipennis* except that the uppermost tooth of the latter is still less developed.

King George's Sound; in the collection of the Hon. W. Macleay.

H. RAUCINASUS, sp.nov.

Elongatus; sat convexus; postice leviter dilatatus; sat nitidus; piceo-ferrugineus, antennis palpisque testaceis, pilis adpressis sat brevibus albidis vestitus; capite crebre rugulose, prothorace sparsius fortiter, elytris squamose sat crebre, pygidio sparsim sat fortiter, punctulatis; tibiarum anticarum dentibus externis robustis; labro clypeum sat fortiter minus late superanti (illo antice ruguloso); antennis 8-articulatis; unguiculis appendiculatis. [Long. $4\frac{4}{5}$, lat. $2\frac{2}{5}$ lines.

Clypeus very slightly emarginate and with the reflexed margin scarcely indicated in the middle; "trilobed outline" of head well

defined, the middle lobe appearing not much more than half as wide as, but rather longer than, the lateral ones. The entire surface of the head is nearly even with scarcely a trace of a clypeal suture. Prothorax not much more than half again as wide as long; its base about half again as wide as front which is moderately emarginate with angles neither very prominent nor very sharp; it is slightly wider just behind the middle than at the base; sides gently arched; hind angles viewed from above appearing moderately distinct and rectangular but neither sharp nor noticeably directed hindward; the base feebly bisinuate and feebly lobed. Elytra with scarcely any indication of any (even a sutural) stria, their transverse wrinkling fairly conspicuous, their lateral fringes normal, their apical membrane rather indistinct. The puncturation of the elytra is much like that of *H. gracilipes* while the prothorax is considerably less closely punctured than in that species. The hind femora are not very much wider than the intermediate, their inner apical angle feebly prominent and much rounded. The hind coxæ, metasternum, ventral segments and legs agree with the description of those parts in *H. punctipennis* except that on the anterior tibiæ the teeth are evidently stouter, the uppermost being larger, moreover, in proportion to the others.

Adelaide district. A specimen (in the collection of the Hon. W. Macleay) from Gunning, N.S.W., seems to differ only in its darker colour.

H. PIGER, sp.nov.

Elongatus; sat convexus; postice vix dilatatus; sat nitidus; ferrugineus, antennis palpisque testaceis; pilis adpressis brevibus albidis vestitus; capite crebre rugulose, prothorace sat fortiter sat crebre (hoc quam longiori duplo latiori), elytris squamose sat crebre, pygidio sat fortiter sat crebre, punctulatis; tibiarum anticarum dentibus externis validis; labro clypeum sat late subfortiter superanti (illo antice ruguloso); antennis 8-articulatis; unguiculis appendiculatis. [Long. 6, lat. 2⅘ lines.

Clypeus moderately emarginate, its reflexed margin nearly obliterated in the middle; "trilobed outline" of head very well

defined, the middle lobe appearing not much more than half as wide as, and scarcely longer than, the lateral ones. Entire surface of head nearly even, with scarcely a trace of a clypeal suture. Prothorax just twice as wide as long, its base rather more than half again as wide as its front, which is moderately emarginate and gently bisinuate, with sharp but not very strongly produced angles; its sides are gently arched, and diverge from the front to near the base, thence becoming nearly parallel; hind angles (viewed from above) appearing defined, but hardly pointed; or directed hindward; base only feebly bisinuate and not strongly lobed in middle. Elytra with only sutural stria (and that not in all lights) distinct, their transverse wrinkling not conspicuous, their lateral fringes normal, their apical membrane obscure, their puncturation a trifle finer and closer than the same in *H. gracilipes* (the puncturation of the prothorax also being much as in that species). The hind femora are only moderately wider than the intermediate, their inner apical angle moderately prominent but not sharp. The hind coxæ, metasternum, and ventral segments do not seem to differ noticeably from the same in *H. punctipennis* and *raucinasus*, the teeth on the anterior tibiæ resembling those of the latter.

Taken at the Grange, near Adelaide.

H. CONSTANS, sp.nov.

Elongatus; sat convexus; postice leviter dilatatus; sat nitidus; piceo-niger, antennis palpisque testaceis; pilis minus brevibus (nonnullis postice inclinatis, nonnullis erectis) fulvo-griseis conspicue sat dense vestitus; capite prothoraceque sat fortiter sat crebre, elytris squamose paullo minus crebre, pygidio (hoc longe hirsuto) sparsius fortius, punctulatis; tibiarum anticarum dentibus externis validis; labro clypeum minus late subfortiter superanti; antennis 8-articulatis; unguiculis appendiculatis.

[Long. $5\frac{2}{5}$-$6\frac{2}{5}$, lat. $2\frac{4}{5}$-$3\frac{1}{5}$ lines.

The head scarcely differs from that of *H. piger*, except that the upper outline of the labrum is a little more convex so that

the middle lobe of the "trilobed outline" appears a little narrower. The prothorax is about $\frac{3}{4}$ again as wide as long, and the base is in about the same proportion wider than the front, which is deeply emarginate, with sharp prominent angles; the sides are nearly straight in their hinder half, thence converging arcuately to the front (the segment is slightly at its widest a little in front of, not *at*, the base), forming right angles (but somewhat rounded off at extreme apex) with the base—as viewed from above—the base being somewhat bisinuate and moderately lobed in the middle. The elytra have little or no trace of striation, their transverse wrinkling being fairly distinct, their lateral fringe normal, and their membranous apex fairly defined. The general puncturation of the upper surface resembles that of *H. gracilipes*—the prothorax being, however, rather less closely and less strongly, the elytra decidedly more squamosely, punctured. A marked character of the species is its decidedly close, not very short, pale dirty brown pubescence, which is for the most part inclined backward but not closely adpressed, with a good many erect hairs rather longer than the rest. The hind femora are considerably wider than the intermediate, their inner apical angle well produced but not sharp. The hind coxæ are only a little shorter than the metasternum and very much longer than the second ventral segment. The metasternum is rather strongly punctured all across—more closely at the sides than in the middle; the hind coxæ much more sparingly especially on the antero-internal region. The ventral segments are very distinctly punctulate, more closely and strongly at the sides than in the middle. The ventral series consist of long and rather fine hairs and are well defined. The teeth of the anterior tibiæ are very robust, the uppermost being decidedly more than half the size of the second tooth.

Widely distributed in S. Australia but apparently not very common.

H. NIGELLUS, Er.

Minus elongatus; convexus; postice leviter dilatatus; sat nitidus; nigro-piceus; sat sparsim griseo-pubescens; capite crebre

rugulose, prothorace fortiter minus crebre, elytris fortiter subsquamose minus crebre, pygidio (hoc capillis erectis dense vestito) crebre minus fortiter, punctulatis; tibiarum anticarum dentibus externis validis; labro clypeum minus late sat fortiter superanti; antennis 8-articulatis; tarsorum posticorum articulo basali secundo fere tertia parte breviori;* unguiculis appendiculatis.

[Long. 4, lat. $2\frac{1}{5}$ lines.

Clypeus with a strongly reflexed margin obsolete in the middle, which is rather strongly emarginate; "trilobed outline" of head strongly defined—the middle lobe appearing less than half as wide, and the same length, as the lateral ones. The clypeus does not form an even surface with the rest of the head, and the clypeal suture is strongly impressed and somewhat angulated in the middle. The prothorax is slightly more than half again as wide as long, its base about half again as wide as its front, which is rather strongly emarginate with sharp prominent angles; the sides are nearly parallel in their basal half, thence arcuately converging forward and forming (as viewed from a particular point above) rather sharp right angles with the base, which is moderately bisinuate and rather strongly lobed in the middle. The transverse wrinkling of the elytra is only moderately defined, there is scarcely any trace of striation, the lateral fringe is normal, the apical membrane well defined. The general puncturation is coarser than in any of the species hitherto mentioned in this Memoir as common, but it nevertheless bears much resemblance to that of *H. gracilipes*. The hind femora are very little wider than the intermediate, their inner apical angle scarcely prominent. The hind coxæ are much shorter than the metasternum (both being rather strongly, and at the sides closely, punctured—the latter more sparingly in the middle, the former obsoletely in the antero-internal region) and very evidently longer

*The length of the basal joint is of course measured from its point of insertion within the apical cavity of the tibia; casually glanced at it appears even shorter still.

than the second ventral segment, which with the other ventral segments is punctured moderately all across. The ventral series are fine and not particularly conspicuous. The teeth of the anterior tibiæ are fairly robust and sharp, the uppermost being about half the size of the second.

N.B.—The identification of this insect has fared badly. The original description unfortunately omits the following characters without which certainty is hopeless apart from examination of the type, viz., the relation of the labrum and the clypeus to each other, the number of joints in the antennæ, and the details of the claws. The latter two are implied by the assignment of the species to *Silopa*, but as the acceptance of this evidence would place all Erichson's *Heteronyces* in one small group of the genus (viz., that with 9-jointed antennæ and claws bifid at the apex) it cannot be considered conclusive. Dr. Burmeister tabulates *H. nigellus*, Er., as having 9-jointed antennæ. M. Lacordaire expressly states that it has 8-jointed antennæ, but adds that its hinder claws are simple. The specimen described by me above was taken in Tasmania and bears the name "*nigellus*, Er.," in the collection of the Hon. W. Macleay. It agrees very fairly with Erichson's description except in being somewhat larger than the size given. But the character on which I rely most in its identification is the colour of the antennæ which are pitchy black with the base paler,—a character specially mentioned by Erichson, and of which I know scarcely another example among the species of *Heteronyx* that I have examined. I cannot help thinking that M. Lacordaire's observation of the claws was inaccurate.

H. DUBIUS, sp.nov.

Sat elongatus; postice minus dilatatus; sat convexus; piceo-ferrugineus, antennis palpisque testaceis, pedibus in parte et abdomine toto rufis; capite crebre rugulose, prothorace fortiter minus crebre, elytris fortiter subsquamose minus crebre, pygidio (hoc capillis erectis vestito) sat crebre minus fortiter, punctulatis; tibiarum anticarum dentibus externis inferioribus 2 validis; labro

clypeum sat late sat fortiter superanti; antennis 8-articulatis; tarsorum posticorum articulo basali secundo vix breviori*; unguiculis appendiculatis. [Long. $4\frac{3}{5}$, lat. $2\frac{2}{5}$ lines (vix).

This insect is so close to *H. nigellus*, Er., that it would be waste of time and space to add to the above diagnosis more than a statement of the respects in which the description of *H. nigellus* would not agree with it. I distinguish it mainly by its testaceous antennæ, and the elongate basal joint of the posterior tarsi which (from its actual *root*) is scarcely shorter than the second joint. I observe also the following slight differences, viz., the colour in general (possibly only an individual peculiarity except in respect of the antennæ, which in no species that I have seen vary with the general colour of the surface), the wider and slighter sinuation of the clypeus in front displaying a wider piece of the labrum, the in general slightly closer puncturation of every part, the less developed apical membrane of the elytra and the much feebler uppermost tooth of the anterior tibiæ. The hind coxæ also are less narrowed inwards from the external margin, and (in the example before me) there is little or no pubescence on the prothorax and elytra,—except of course the fringes.

A single example was taken by Mr. J. G. O. Tepper, at Norton's Summit near Adelaide.

H. AURICOMUS, sp.nov.

Minus elongatus; postice vix dilatatus; sat convexus; ferrugineus, antennis palpisque testaceis; pilis aureo-brunneis sat dense vestitus; capite crebre rugulose, prothorace elytrisque sat fortiter minus crebre, pygidio sat sparsim sat leviter, punctulatis; tibiarum anticarum dentibus externis validis acutis; labro clypeum minus late sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. 4, lat. 2 lines.

Clypeus with reflexed margin not obsolete in middle which is distinctly emarginate; "trilobed outline" of head only moderately

* Vide note on page 156.

defined, otherwise as that of *H. nigellus;* surface of clypeus not quite uniform with that of rest of head, clypeal suture fairly impressed and angulated. Prothorax about three-fifths again as wide as long, its base less than half again as wide as its front, which is moderately emarginate, with fairly prominent angles; the sides converge arcuately from base to front; most strongly near front; they form (viewed from above) strongly rounded angles with the base which is moderately bisinuate and feebly and widely lobed in the middle. The puncturation of the elytra is very uniform with that of the prothorax, except that it shows a little tendency to be squamose; the transverse wrinkling of the elytra is feeble, their lateral fringe normal, their apical membrane little defined. The prothorax is evidently more sparingly and feebly punctured than that of *H. nigellus, gracilipes,* &c., and much more closely than that of *Augustæ* and others; the elytra are more sparingly punctured than is usual in the genus. The hind femora are evidently wider than the intermediate, their inner apical angle rather feeble and blunt. The hind coxæ are considerably shorter than the metasternum and longer than the 2nd ventral segment. The description of the anterior tibiæ and the puncturation of the under surface in *H. nigellus* (above) may be applied to this species; the ventral series, however, seem more conspicuous than in *H. nigellus,* and the uppermost tooth on the anterior tibiæ is a little more acute.

Darling River; in collection of Hon. W. Macleay.

H. CYGNEUS, sp.nov.

Sat elongatus; postice vix dilatatus; sat convexus; ferrugineus; pilis sat dense vestitus; clypeo crebre rugulose, capite postice minus crebre, prothorace elytrisque sat fortiter minus crebre, pygidio sat sparsim sat leviter, punctulatis; tibiarum anticarum dentibus externis inferioribus 2 validis; labro clypeum sat late sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. $3\frac{4}{5}$, lat. $1\frac{4}{5}$ lines.

Very close to *H. auricomus*, but differing as follows; the labrum is more widely and strongly prominent so that the middle lobe of the "trilobed outline" appears longer than and more than half as wide as the lateral lobes; the clypeus is less distinctly margined in the middle of its front; the puncturation of the hind part of the head is much less uniform with that of the clypeus; the hind angles of the prothorax are much better defined; the apical membrane of the elytra is well defined; the uppermost tooth on the anterior tibiæ is much feebler, being much less than half as large as the middle tooth, the external outline of the tibia (from its base to the apex of the uppermost tooth) being straight, whereas in *auricomus* that outline is more or less concave. The general form, moreover, is a little more elongate and parallel than that of *H. auricomus*.

Kangaroo Island; taken by Mr. J. G. O. Tepper and others.

H. ELECTUS, sp.nov.

Sat elongatus; postice vix dilatatus; sat convexus; ferrugineus, antennis pallidioribus; pilis fulvis vestitus; capite crasse rugulose, prothorace elytrisque sat fortiter sat sparsim, pygidio subtilius nec crebre, punctulatis; tibiarum anticarum dentibus externis inferioribus 2 validis; labro clypeum sat late sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis.

[Long. $4\frac{2}{5}$, lat. $2\frac{1}{5}$ lines.

Clypeus with reflexed margin obsolete in middle which is widely and gently emarginate; "trilobed outline" of head moderately defined, the middle lobe appearing more than half as wide and the same length as the lateral ones; sides of clypeus less arched than in some species of the genus (e.g. *H. auricomus* and *cygneus*); surface of clypeus nearly uniform with that of rest of head; clypeal suture feebly impressed and nearly straight. Prothorax not much less than twice as wide as long, the base nearly half again as wide as the front, which is rather strongly emarginate with sharp prominent angles, the sides gently rounded

forming (viewed from above) feeble obtuse angles with the base, which is scarcely bisinuate and but feebly lobed hindward all across. The puncturation of the elytra scarcely differs from that of the prothorax except in being a little squamose; the transverse wrinkling is well defined, the lateral fringe normal, the apical membrane well defined. The general puncturation resembles that of *H. auricomus*, but with the transverse wrinkling of the elytra much more conspicuous. The under surface and legs do not appear to differ noticeably from the same parts in *H. auricomus* except in the hind coxæ being a little narrower, and the uppermost external tooth on the front tibiæ considerably smaller; the external outline of the anterior tibia from its base to the apex of the uppermost tooth is almost quite straight in this species, while in *H. auricomus* it is quite strongly concave.

Port Lincoln; not rare.

N.B.—Some smaller specimens (long. $3\frac{1}{5}$ lines)—also from Port Lincoln—are of a pale testaceous colour and seem to have the prothorax slightly more sparsely punctured, but I am not satisfied of their specific distinctness. They have the same slight but decided peculiarity in the nearly straight sides of the clypeus, giving the head in front of the eyes (from some points of view) something of the appearance of the sides presenting two truncate faces.

H. CRASSUS, sp. nov.

Minus elongatus; postice vix dilatatus; sat convexus; ferrugineus, antennis palpisque testaceis; pilis sat longis vestitus; clypeo crebre rugulose, capite postice sparsius rugulose, prothorace sparsim crasse, elytris crasse squamose nec crebre, pygidio subtilius sat crebre, punctulatis; tibiarum anticarum dentibus externis inferioribus 2 validis; labro clypeum sat late minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. $4\frac{2}{5}$ (vix), lat. $2\frac{1}{5}$ lines.

Clypeus widely and feebly emarginate in front, its reflexed margin scarcely continuous; "trilobed outline" of head rather

feeble, the middle lobe appearing considerably more than half as wide as the lateral ones; surface of clypeus almost uniform with rest of head, clypeal suture finely impressed, angulated in middle. Prothorax about half again as wide as long, the base a little more than half again as wide as the front, which is rather strongly emarginate and slightly bisinuate with sharp prominent angles, the sides gently arched, the hind angles quite rounded off, the base scarcely bisinuate but moderately lobed hindward all across. The puncturation of the elytra is very squamose in appearance, the transverse wrinkling strongly defined, the lateral fringe normal, the apical membrane distinct. The sculpture of the upper surface is extremely like that of *H. fulvo-hirtus* (Section I. of the genus). The hind coxæ are much shorter than the metasternum and evidently longer than the second ventral segment. The under surface is rather evenly punctured, closely and moderately strongly on the sides,—more sparsely and feebly in the middle, the impunctate antero-internal space on the hind coxæ being scarcely noticeable. The ventral series are moderate; the hind femora moderately wider than the intermediate, their inner apical angle rounded and little prominent. The uppermost tooth on the anterior tibiæ is very small. The external outline of the tibia from its base to the apex of the uppermost tooth is straight.

Port Lincoln.

H. AUGUSTÆ, sp.nov.

Minus elongatus; postice sat dilatatus; sat convexus; ferrugineus, antennis palpisque testaceis; pilis pallidis vestitus; capite crebre rugulose, prothorace subtilius sat sparsim, elytris subtilius sat crebre squamose, pygidio leviter minus crebre, punctulatis; tibiarum anticarum dentibus externis validis; labro clypeum sat late sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. $5\frac{1}{4}$, lat. $2\frac{3}{5}$ lines.

The head scarcely differs from that of *H. crassus*; the labrum, however, rising slightly more above the level of the clypeus, and the puncturation of the hinder part of the head differing less

from that of the clypeus. The prothorax is nearly twice as wide as long, the base slightly more than half again as wide as the front, which is rather strongly emarginate with sharp prominent angles, the sides gently arched, the hind angles quite rounded off, the base evidently bisinuate and moderately lobed hindward in the middle. The puncturation of the elytra is rather fine and lightly impressed, not very close, very squamose in appearance, the transverse wrinkling well marked but fine, the lateral fringe normal, the apical membrane fairly defined. Of the commoner species perhaps *H. constans* comes nearest to this in respect of elytral puncturation, but the prothoracic sculpture resembles that of *H. fulvo-hirtus* and *crassus*, though evidently finer than in either of those species, and a little more sparing than in the former. The under surface and legs are as the same parts in *H. crassus*, except that there is a more evident impunctate space on the antero-internal part of the hind coxæ, and that the external teeth of the front tibiæ are more robust, the uppermost being very fully half as large as the second, and the external outline of the tibia from its base to the apex of the uppermost tooth being gently concave.

Port Augusta; dug up from the soil at the roots of *Eucalyptus*.

H. ANCEPS, sp.nov.

Sat elongatus; postice vix dilatatus; sat convexus; ferrugineus, antennis palpisque testaceis; pilis fulvis vestitus; clypeo crebre rugulose, capite postice crasse minus crebre, prothorace subtilius sat sparsim, elytris minus crebre subfortiter, pygidio subtiliter leviter sat crebre, punctulatis; tibiis anticis externe minus fortiter dentatis; labro clypeum sat late sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis.

[Long. $4\frac{4}{5}$, lat. $2\frac{2}{5}$ lines.

Very closely allied to the preceding two species and also to *H. piger*. It differs from them as follows:—from *H. piger* by its polished and smoothly (and more sparingly) punctulate labrum, the much less close puncturation of its surface, and other characters; from *H. crassus* by its wider prothorax (not much

less than twice as wide as long) of which the hinder angles are slightly more defined and the base is a little more strongly bisinuate while the surface is evidently more finely and decidedly less sparsely punctured, by the much finer (though still not particularly fine) puncturation of its elytra, by the very unusually fine and close puncturation of the middle part of its ventral segments, the somewhat larger lævigate space at the antero-internal part of the hind coxæ, and by the somewhat feebler external structure of its front tibiæ which have their lower two teeth smaller and evidently shorter than those of *H. crassus* (in all respects not specified above the description of *H. crassus* may be taken as applying to *H. anceps*); from *H. Augustæ* it differs by the much less close puncturation of the hinder part of the head as compared with that of the clypeus, by the somewhat less rotundity of the hind angles of the prothorax (this difference is only slight), by the fine close and strongly defined puncturation of the middle part of the ventral segments, and by the very much feebler external structure of the anterior tibiæ, as well as other characters.

Adelaide district; I find it in several collections, but not in numbers.

H. Sloanei, sp.nov.

Sat elongatus; postice leviter dilatatus; sat convexus; ferrugineus, antennis palpisque testaceis; pilis pallide fulvis vestitus; clypeo crebre rugulose, capite postice crasse minus crebre, prothorace sat fortiter sat crebre (huic angulis posticis, certo visu, rectis), elytris squamose subrugulose sat crebre, pygidio (hoc breviter sparsius piloso) subtilius sparsius, punctulatis; tibiis anticis externe fortiter dentatis; labro clypeum sat anguste sat fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. $4\frac{1}{5}$, lat. $2\frac{1}{10}$ lines.

Clypeus moderately emarginate in front; "trilobed outline" of head well defined, the middle lobe appearing scarcely more than half as wide, and about the same length, as the lateral ones; surface of clypeus quite distinct from that of rest of head,

clypeal suture well impressed, and angulated in the middle. Prothorax nearly twice as wide as long, its base more than half again as wide as its front, which is moderately emarginate and very slightly bisinuate with moderate angles, the sides gently arched, the hind angles (viewed from a certain point above) rectangular, the base evidently bisinuate and rather narrowly and decidedly lobed hindward in the middle. The elytra are quite like those of *H. Augustæ*, the legs and underside also not appearing to differ noticeably from those of the same insect save that the uppermost external tooth of the anterior tibiæ is scarcely so strong.

This species bears a good deal of resemblance to *H. piger* (though it is much smaller), but differs by the nitid surface of its labrum; also its puncturation is throughout decidedly coarser. From other allied species it differs *inter alia* as follows :—from *crassus* by the very much closer puncturation of its upper surface; from *Augustæ* by the very much closer and coarser puncturation of its prothorax; from *anceps* by the rectangular (as viewed from a certain point) hind angles of its prothorax (those of *anceps* appearing from any point of view almost entirely rounded off), and different sculpture of the ventral segments; and from all the four just mentioned by the less width of the part of the labrum overtopping the clypeus, the middle lobe of the "trilobed outline" thus appearing narrower.

Melbourne; taken by Mr. Sloane (of Mulwala).

H. LATERITIUS, sp.nov.

Sat elongatus; sat convexus; pone medium leviter dilatatus; sat nitidus; rufo-ferrugineus; pilis adpressis minus dense vestitus; crebrius fortius subæqualiter punctulatus; labro clypeum fortiter minus late superanti; antennis 8-articulatis; unguiculis appendiculatis; coxis posticis abdominis segmento ventrali 2° haud longioribus. [Long. 4, lat. $2\frac{1}{5}$ lines.

Clypeus emarginate in front, without a continuous reflexed margin; "trilobed outline" of head having the middle lobe little

more than half as wide as the lateral ones, rather longer than these, and very strongly convex; clypeal suture gently arched; clypeus unusually convex,—or sub-gibbous, very distinct from hinder part of head. Prothorax about $\frac{3}{5}$ again as wide as long; widest close to the base; its base nearly $\frac{3}{5}$ again as wide as its front which is moderately emarginate with the angles fairly sharp and produced; its sides gently arched, and forming (viewed from above) feebly defined angles with the base which is moderately bisinuate and lobed hindward in the middle. Elytra with more or less feeble indications of striation (most examples showing at least traces of a sutural stria); their transverse wrinkling very strongly (at least in some lights) defined; lateral fringe normal; membranous apex moderate. The puncturation of the upper surface is about as close in all parts as (except the head where it is closer than) in *H. gracilipes*, but is a little finer, more squamose, and less strongly impressed. The hind coxæ are as nearly as possible the same length as the external margin of the 2nd ventral segment, and are very much shorter than the metasternum; like it they are rather coarsely punctulate,—sparsely in the middle, more closely at the sides. The puncturation of the ventral segments does not differ much from that of the metasternum except in being a little finer and nearly uniform all across. The ventral series consist of rather stout hairs and are well defined, but very slender and feeble in the middle. The hind femora are not very much wider than the intermediate and have their inner apical angle fairly prominent but not sharp; all the teeth of the anterior tibiæ are sharp and strong,—the uppermost about half the size of the second.

Adelaide.

H. JEJUNUS, sp.nov.

Sat elongatus; sat convexus; pone medium vix dilatatus; sat nitidus; testaceo-rufus, antennarum clava dilutiori; minus perspicue pubescens; capite (clypeo dense ruguloso excepto) prothoraceque (huic angulis posticis rotundatis) subtilius sparsius, elytris magis fortiter magis crebre, pygidio (hoc pilis perlongis sparsim vestito) crebre fortius, punctulatis; labro clypeum late

minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis; coxis posticis abdominis segmento ventrali 2° haud longioribus. [Long. $3\frac{1}{5}$, lat. $1\frac{3}{5}$ lines.

Clypeus feebly and widely emarginate in front, its reflexed margin not quite obsolete even in the middle; "trilobed outline" of head very feebly visible from any point of view, the lobes appearing when viewed from the most favourable position to be scarcely developed, with the middle one very little narrower than the external ones; clypeus not continuous with the rest of the head; clypeal suture strongly marked and undulating. Prothorax a little less than twice as wide as long; its base about $\frac{1}{5}$ again as wide as its front, which is moderately emarginate with fairly prominent sharp angles; its sides moderately curved, most divergent near the base; its hind angles (viewed from above) much rounded off and not in the least directed hindward; its base scarcely bisinuate and moderately lobed backward all across. Elytra with scarcely a trace even of a sutural stria; their transverse wrinkling fine and inconspicuous; their lateral fringe normal; their membranous apex obscure. The sculpture of the upper surface is evidently coarser and more sparing than of *H. testaceus*, to which insect this species bears a close superficial resemblance. The hind coxæ are of the same length as the second ventral segment, being very much shorter than the metasternum which is closely and moderately strongly punctured at the sides, feebly and sparingly in the middle,—the hind coxæ being nearly impunctate, except the sparingly and coarsely punctulate lateral and hinder portions. The ventral segments are coarsely but not closely punctured,—much more feebly in the middle. The ventral series consist of fine hairs and are little conspicuous. The hind femora are but little wider than the intermediate, with their inner apical angle neither sharp nor very prominent. All the teeth of the anterior tibiæ are sharp and fairly large,—the uppermost scarcely half the size of the second.

Adelaide.

H. DENTIPES, sp.nov.

Sat elongatus; sat convexus; pone medium leviter dilatatus; sat nitidus; piceo-ferrugineus, antennis palpisque testaceis; vix pubescens; clypeo crebre rugulose, capite postice sat fortiter sat crebre, prothorace (huic angulis posticis subrectis) subtiliter sat sparsim, elytris sparsius minus subtiliter, pygidio (hoc pilis perlongis sparsim vestito) fortiter minus crebre, punctulatis; clypeo transversim concavo; sutura clypeali fortiter carinata; tibiarum anticarum dentibus externis perlongis; labro clypeum late minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis; coxis posticis abdominis segmento 2° subbrevioribus.

[Long. 4, lat. 2 lines.

Clypeus truncate in front with its front margin thickened in a triangularly elevated manner; "trilobed outline" of head only fairly developed, the middle lobe appearing better developed and very little narrower than the lateral ones; clypeus of very peculiar form, being subcompressed longitudinally in the middle (thus appearing rather abruptly convex down the middle) and at the same time concave transversely; the triangularly elevated apex of the middle part of the clypeus seems to result from the truncation of the compressed portion mentioned above. The clypeal suture appears as a strongly elevated carina or "wheal" bisinuate in front, and at the sides reflexed and running up the head (while gradually sinking to the level of the surface) nearly to the level of the back of the eyes. The prothorax is twice as wide as long, its base a little more than ⅓ again as wide as its front which is moderately emarginate with fairly prominent sharp angles; its sides diverging from front to behind middle, thence nearly straight to base, with which they form angles that viewed from a certain position above appear (quite sharply) rectangular; the base distinctly (from some points of view *strongly*) bisinuate and moderately lobed in the middle. Elytra with faint suggestions of striation, their transverse wrinkling scarcely marked, their lateral fringes normal, their membranous apex obsolete. The punctuation of the upper surface in general is finer, smoother, more sparing

(and consequently more distinct) than in any of the common species hitherto described in this monograph. It is most like that of *H. testaceus* except in being very much less close The hind coxæ are scarcely so wide as the second ventral segment and very much shorter than the metasternum. The sculpture and pubescence of the under surface scarcely differ from those of the preceding species (*H. jejunus*). The hind femora are decidedly wider than the intermediate, with their inner apical angle rather prominent but a good deal rounded off. The lower two teeth of the anterior tibiæ are unusually long and slender, the uppermost sharp but small (less than half the size of the second).

S. Australia (Balaclava).

H. DEBILIS, sp.nov.

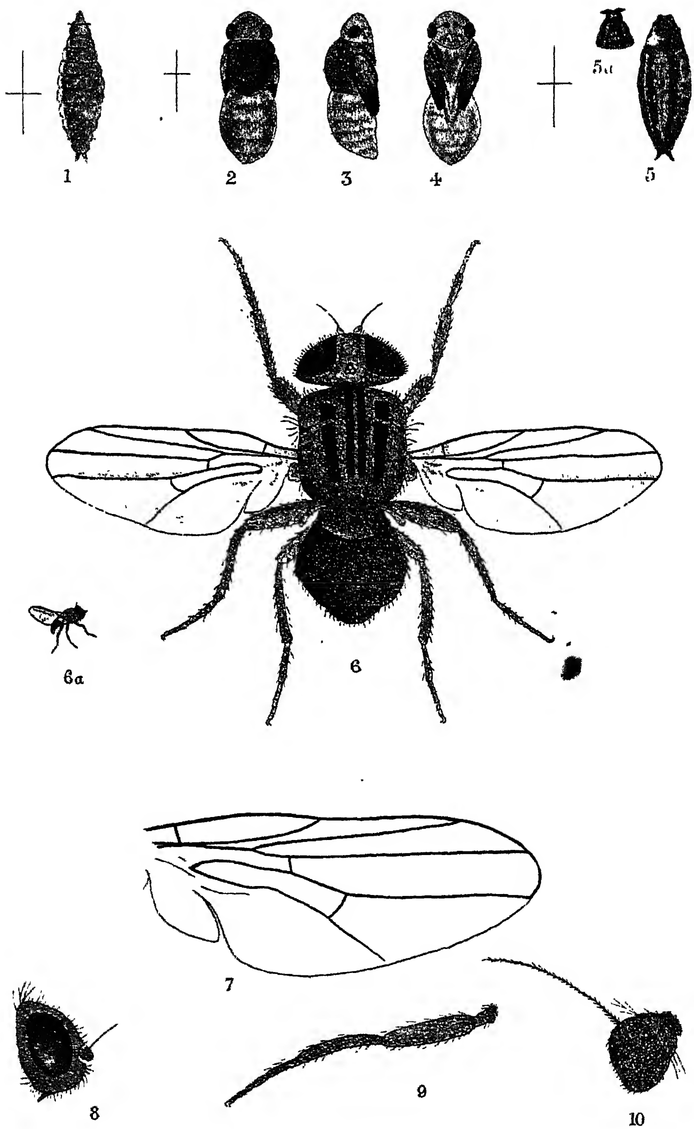
Sat elongatus; sat convexus; pone medium leviter dilatatus; sat nitidus; piceo-ferrugineus, antennis palpisque dilutioribus; vix pubescens; clypeo crebre rugulose, capite postice sparsim subtiliter, prothorace minus sparsim minus subtiliter (huic angulis posticis subrectis), elytris confuse subsquamose sat crebre, pygidio (hoc longitudinaliter subcarinato) fortius crebrius, punctulatis; tibiarum anticarum dentibus externis perlongis; labro clypeum latissime minus fortiter superanti; antennis 8-articulatis; unguiculis appendiculatis. [Long. $3\frac{2}{5}$, lat. $1\frac{4}{5}$ lines (vix).

Clypeus gently emarginate in front, its reflexed margin scarcely indicated in the middle part; owing to the slight convexity of the upper outline of the labrum the appearance of a "trilobed outline" of the head is only obscurely attainable from a point of view far back and almost level with the surface of the head. The clypeus does not quite form an even surface with the rest of the head; the clypeal suture is well impressed and nearly straight. The prothorax does not differ from that of the preceding except in its puncturation being a little less fine, and indeed in all other respects the description of *H. dentipes* may be taken as applying to this species with the following qualifications, viz., the sculpture

of the elytra is somewhat coarser (a little squamose in appearance) with more evident transverse wrinkling, and the uppermost tooth on the anterior tibiæ is somewhat more developed.

It will thus appear that the present insect is very close to the preceding, differing chiefly in the structure of the labrum, clypeus, and clypeal suture, and the very much finer and more sparing punc-turation of the hinder part of the head. I think, however, that it is really distinct, as the differences just mentioned are not of a kind that appear to distinguish the sexes in this genus (I do not think that I have seen a male of either species), and moreover are accompanied by decided though slight differences in general sculpture, &c. It may be noted also that *H. debilis* is a more nitid species than *H. dentipes.*

S. Australia; Sedan, taken by Mr. B. S. Rothe.



F.A.A. Skuse, del.

Baron & Barward lith.

DESCRIPTION OF A NEW GENUS (*BATRACHOMYIA*, W. S. MACLEAY, MS.), AND TWO SPECIES OF DIPTEROUS INSECTS PARASITIC UPON AUSTRALIAN FROGS.

By Frederick A. A. Skuse.

(Plate x.)

More than twenty years ago Mr. George F. Angas reared a Dipterous insect from a small frog, *Cystignathus Sydneyensis*, Kr. (=*Crinia signifera*), for which Mr. W. S. Macleay devised the appropriate appellation *Batrachomyia*, but did not characterize the newly discovered genus. The original specimen was deposited in the Australian Museum. The first printed record we have relating to *Batrachomyia* is a note by Mr. Gerard Krefft (then Curator of the Australian Museum), read before the Entomological Society of N.S.W., in 1863 (Trans. I. p. 100), giving an account of the metamorphoses of a fly reared by him from another frog, (*Uperoleia*) *Hyperolia marmorata*, which he considered to belong to the same genus as the above-mentioned fly, but which to all appearance represented another species; the author also roughly figures different stages of the insect's existence, and gives a diagram of the wing of the imago. Mr. Krefft says that the parasite is most common upon *Cystignathus Sydneyensis* (*Crinia signifera*), though he has met with it upon *Pseudophryne Bibronii*; and he observes that whenever he found specimens of *Hyla Citropus* they were always infested with them; but although the larvæ all reached the pupa state he could not succeed in keeping them alive afterwards; only in the case of *U. marmorata* had the attempt been successful. Both these specimens appear to have been subsequently mislaid, for Mr. Olliff has on more than one occasion searched in vain for them in the Entomological

Collection of the Australian Museum; I have, however, lately found a single specimen each of the pupa and imago labelled "*Batrachomyia 4-lineata;* in frogs of N.S.W.," in the collection of the late Mr. W. S. Macleay.

Between the months of June and December of last year Mr. J. J. Fletcher obtained and kindly handed over to me three frogs infested with Dipterous larvæ which I have in all cases successfully bred out; I am therefore enabled to publish the characters of the genus, and in addition to compare the few notes I have been able to make with those of Mr. Krefft.

As pointed out by Mr. Krefft, the larvæ are found between the skin and flesh on different parts of the sides and back of the frogs; sometimes only one parasite is present, at others two or three, whilst a spirit specimen of *Heliophorus albopunctatus* from W. Australia, in the Macleay Museum, nursed as many as five. After the emergence of the fly-larvæ the frogs seemed little or none the worse, though according to Mr. Krefft's statement they ought to have succumbed to the effects of the parasites. His frogs, however, may have died of starvation. The presence of a full grown larva is indicated by a glandular-looking swelling of the skin about half an inch in length and having a small aperture at one end. Having lived in their host for a certain at present unknown time, the larvæ leave their nidus and crawl away to some dark and damp situation (such as the underside of a log or a stone*), become quiescent; while their skin hardens gradually, blackens, and becomes the puparium. The newly emerged larva is extremely averse to the light, crawls very slowly, moving the anterior portion of its body from side to side as if surveying the situation or looking for some convenient spot in which to pupate.

As all my larvæ, except one, emerged and assumed the next stage during the night, and as I was unwilling to sacrifice the only live specimen which I had the brief opportunity of examining, besides its being the only example reared from *Pseud. Bibronii*, I can

* Last October, I found in a damp umbrageous spot on Saddle-back Mountain, near Kiama, a puparium attached to the underside of a leaf.

simply give a very general description of its appearance. There may be marked specific distinctions between the larvæ of different species. Mr. Krefft mentions that the larva found by him in *Hyla Citropus* varied in structure considerably from all others. I must postpone for the present a critical examination of the mouth-parts. The living larva is pale lemon-yellow, very soft, glabrous, with the skin pellucid; elliptic-ovate, 11-segmented (including head), with very indistinct stigmata; head with two divaricate tentacles; posterior extremity of the body furcate. The posterior tentacles evidently aid in progression.

Pupa exhibiting the general appearance of the imago, entirely enveloped in an extremely delicate transparent skin fitting glove-like round the insect. Arista of the antennæ overlapping the eyes at the tip, directed sidewards. On the underside the wings reach to about the posterior margin of the second abdominal segment, but are separated from each other at the tips. Fore and intermediate legs beginning at the shoulders (with the tibiæ) running between the wings, the fore tarsi reaching to a little above the extremity of the wings, the intermediate terminating level with the extremity. Tarsi of the hind-legs issuing from under the wings just before the tip, almost touching at the tips, nearly reaching the posterior margin of the fourth abdominal segment.

Puparium exhibiting the general appearance of the larva, black, opaque, with more or less distinct transverse wrinkles.

Six species of Australian frogs at least are known to be subject to the attacks of *Batrachomyia*, but at present it cannot be stated definitely whether or no each species of frog harbours its own special species of fly, though as both the flies now described were only bred from particular frogs, it seems not at all improbable that this will ultimately be found to be constantly the case with all species.

The specimen in the Macleay collection named *Batrachomyia quadrilineata*, belongs to the same species as an example reared by me from *Pseudophryne Bibronii;* it is unfortunate that the label of the former does not specify any particular frog.

As far as observations go, the time of year at which the larvæ leave the frog is indefinite, and the duration of the several stages

of existence from the emergence to the imago state is equally uncertain, as the following table will show; but it is not improbable that the seasonal differences of temperature, and the necessarily artificial conditions under which their hosts lived in confinement may have had something to do with the latter.

Name of Frog.	Obtained.	Larvæ emerged.	Puparium formed.	Fly emerged.
Hyperolia (Uperoleia) marmorata.........	Begin. April.	"In a few days."	"In 36 hours."	32 days.
Hyla phyllochroa....... (Containing three larvæ.)	June 26.	July 16.	During night.	*
	,,	July 17.	,,	62 days.
	,,	July 19.	,,	63 days.
Hyla phyllochroa....... (Containing one larva).	Nov. 10.	December 1.	,,	24 days.
Pseudophryne Bibronii (Containing one larva).	,,	January 30.	During day. (in about 12 hours ?)	22 days.

* One puparium was opened on September 4th in order to obtain the pupa for descriptive purposes.

N.B.—In rearing the larvæ I have followed the course adopted by Mr. Krefft, of placing the frog in a glass vessel provided with damp moss and earth.

Batrachomyia, gen. nov. (W. S. Macleay, MSS.)

Head transverse, as broad as the thorax; vertex with a very few short bristles; front flattened; face oblique. Eyes rather rounded, but higher than broad. Antennæ very short, not reaching the epistoma; third joint twice the length of the second, nearly round, a little emarginate at the base; sixth slender, bare (pl. x., fig. 10). Thorax rather longer than broad, with a few short lateral bristles; transverse suture distinct at each side; scutellum rather small, semicircular, rounded at the corners, fringed with short bristles. Abdomen ovate, five-segmented; first segment large, as long as the three next following; last two segments and anal joint much narrower than the preceding segments, curved downwards. Legs

of moderate length and thickness; tibiæ without bristles, the intermediate pair with very small spurs; hind femora slender; hind tibiæ slightly curved (pl. x., fig. 9). Wings rather short and broad; costal vein without bristles, ending at the tip of the fourth longitudinal; auxiliary vein wanting, its course indistinctly indicated by a pale wing-fold-like line; first longitudinal vein gradually bent, terminating in the costa at a point rather beyond mid-way between the transverse shoulder vein and the tip of the second longitudinal, and opposite the posterior transverse vein; third longitudinal vein originating opposite a point mid-way between the transverse shoulder vein and the tip of the first longitudinal; hinder transverse vein slanting; foremost of the two small basal cells united with the discal cell, the posterior one entirely wanting; sixth longitudinal vein stopping immediately before reaching the border * (pl. x., fig. 7).

Obs.—Judging by the above characters this genus might be considered identical with *Oscinis*, but the far greater size and peculiar habits of the contained species both give it an unmistakable distinction, and to my mind justify the retention of Mr. Macleay's generic name.

Batrachomyia nigritarsis, sp.n.

♂.—Long $2\frac{3}{4}$; alar. $2\frac{1}{2}$ lines; ♀ long $3\frac{1}{2}$; alar. $3\frac{1}{4}$. Antennæ entirely black. Head ferruginous-ochre; the pubescence on the front and short bristles on the vertex black. Ocelli on a small deep brown or black triangular patch. Eyes black, with pale yellow pubescence. Thorax ochreous-brown, shining, densely covered with short black hairs; very indistinct traces of four light brownish bands similarly disposed to those in *B. quadrilineata;* pleuræ and pectus bright ochreous or ferruginous-ochreous, the latter with short yellow hairs; scutellum ochreous or brownish-ochreous with short black hair, fringed at the apex

* This vein runs so close to the border that the fact of its really not reaching it can only be ascertained by very close examination with the ordinary lens.

with short black bristles; metanotum ochreous-brown, shining. Halteres pale ochre-yellow or brownish-ochreous. Abdomen shorter than the thorax (in dried specimens), as broad as it or a little broader, shining, castaneous, tinged with ochreous-brown, the last two segments wholly ochreous in the ♀; clothed with short black hairs, intermixed with some yellowish hairs in the ♀; anal joint in the ♂ nodose, in the ♀ pointed. Legs densely clothed with yellow hairs. Coxæ and femora ochreous, the latter black at the apex. Tibiæ and tarsi black, the hind tibiæ ochreous or brownish-ochreous, black at the base and apex; ungues black. Wings considerably tinted with yellow on the anterior portion of the basal half, the remainder hyaline: veins dark brown, ochreous-brown towards the base of the wing; very pale reflections. Middle transverse vein erect in the ♂, slanting in the ♀; posterior transverse vein straight, separated from the middle transverse vein a distance equal to twice its length (rather more than this in the ♀), and at a point mid-way between the latter and the tip of the fifth longitudinal vein.

Larva, ♀, long 5½; broad 2 lines. Puparium, ♂, long 4½; broad 2. ♀, long 5½; broad 2¼.

Hab.—Illawarra, &c., N.S.W. Bred from two specimens of *Hyla phyllochroa*, obtained by Mr. Fletcher in June and November respectively.

BATRACHOMYIA QUADRILINEATA, sp.n. (W. S. Macleay, MSS.)

♂.—Long 2½-3; alar. 2¼ lines. Antennæ ochreous-brown or ferruginous, the arista deep brown or black. Head ochreous or ferruginous-ochre; the pubescence on the front and short bristles on the vertex black. Ocelli on a small deep brown or black triangular patch. Eyes black (deep olivaceous whilst living), with pale yellow pubescence. Thorax ochreous-brown, shining, rather densely covered with short yellow hairs; traversed by four parallel longitudinal narrow bands of black, the lateral ones somewhat broader than the median two, starting below the humeri, completely interrupted near the anterior extremity by the transverse suture (thus cutting off a squarish portion), not

reaching as far as the scutellum, the median ones close together, starting from the anterior margin, not reaching quite as far posteriorly as the lateral ones; pleuræ and pectus ochreous or ochreous-brown, the latter with yellow hairs; a small black spot before the intermediate coxæ, and another much smaller almost linear before the hind coxæ; scutellum ochreous or brownish-ochre, shining, covered with short black hairs, fringed at the apex with short black bristles; metanotum shining black. Halteres pale ochre-yellow, more brownish towards the base of the stem. Abdomen shorter than the thorax (in dried specimens), as broad as it or a little narrower, brown, more or less castaneous, tinged with ochreous, shining, clothed with short yellow hairs. Legs brownish-yellow, with a dense short yellow pubescence; ungues brown. Wings very slightly ochreous at the base, hyaline, the veins dark brown or blackish, ochreous-brown towards the base of the wing; delicate opaline reflections. Middle transverse vein erect; posterior transverse vein slightly bent, separated from the middle transverse vein a distance equal to scarcely twice its length, and at a point rather nearer to the latter than to the tip of the fifth longitudinal vein (pl. x., fig. 7).

Larva, long $4\frac{1}{4}$; broad $1\frac{3}{4}$ lines. Puparium, long 4; broad $1\frac{4}{5}$ lines; with rather more distinct transverse wrinkles than in the last species.

Hab.—Burrawang, N.S.W. Bred from specimen of *Pseudophryne Bibronii* obtained by Mr. Fletcher in November.

EXPLANATION OF PLATE X.

Fig. 1. Larva of *Batrachomyia quadrilineata.*
Fig. 2. Pupa of *Batrachomyia nigritarsis* (back view).
Fig. 3. ,, ,, ,, (side view).
Fig. 4. ,, ,, ,, (front view).
Fig. 5. Puparium of *Batrachomyia nigritarsis.*
Fig. 5a. ,, ,, ,, anterior portion detached on the escape of the imago.
Fig. 6. *Batrachomyia quadrilineata.*
Fig. 6a. ,, ,, natural size.
Fig. 7. Diagram of wing of *Batrachomyia quadrilineata.*
Fig. 8. Head } of *Batrachomyia quadrilineata.*
Fig. 9. Hindleg }
Fig. 10. Antenna }

LIST OF THE AUSTRALIAN *PALÆICHTHYES*, WITH NOTES ON THEIR SYNONYMY AND DISTRIBUTION.

By J. Douglas Ogilby, F.L.S.,
Assistant Zoologist, Australian Museum.

Part II.

In this part are contained the remaining families of the Selachoidean *Palæichthyes*, namely, the *Notidanidæ*, *Scylliidæ*, *Heterodontidæ*, *Spinacidæ*, *Squatinidæ*, and *Pristiophoridæ*: of these twenty-five species are enumerated, seven of which, *i.e.*, *Scylliorhinus analis*, *Ginglymostoma concolor*, *Stegostoma tigrinum*, *Parascyllium collare*, *Chiloscyllium punctatum*, *Crossorhinus dasypogon*, and *Echinorhinus spinosus*, have been added to the Australian fauna since 1884. Two of these (*S. analis* and *P. collare*) have been described since that date in the Proceedings of this Society, the former in Vol. x. p. 445, the latter in Vol. iii. (2) p. 1310; for the record of *E. spinosus* we are indebted to Prof. McCoy, who has done so much to elucidate the zoology of Victoria both fossil and recent; while that of *C. punctatum* is due to Dr. Klunzinger; the remaining three, being well-known species from the tropical waters of the Indian and Pacific Oceans, were certain to have been recorded sooner or later from our northern shores, as without doubt will many other species when our long and varied sea-board has been systematically examined.

In the present part the only points on which I feel any doubt concern (1) the correctness of the identification of Mr. Zietz's South Australian *Crossorhinus* with the *C. tentaculatus* of Dr. Peters, but in the present state of our knowledge of both forms it is perhaps better to follow Mr. Zietz, who, in a letter received

subsequently to the writing of my note on this species, informs me that he has decided to describe the South Australian fish as distinct under the name of *C. stirlingi;* (2) the propriety of separating the three alleged species of *Acanthias*, the characters of which I find to vary greatly; and (3) the specific value of *Pristiophorus nudipinnis.*

In connection with the synonymy I have felt it incumbent upon me to alter the names of the following genera :—*Notidanus* to *Heptanchus*, *Scyllium* to *Scylliorhinus*, and *Rhina* to *Squatina.*

NOTIDANIDÆ.

Heptanchus, Rafinesque (1810).

21. H. indicus, *Cuv., sp.* Coast of New South Wales, common. The "Seven-gilled Shark." Victoria, one of the rarer sharks in Hobson's Bay (*Mc Coy*). Tasmania (*Allport, MS.*). Rafinesque's excellent name having the priority of that of Cuvier by several years, I can see no reason whatever for its rejection, and I therefore unhesitatingly adopt it. The increased number of the gill-openings being the more important of the two principal differences between this and the two preceding families, I am at a loss to understand—seeing that a genus is merely a number of species, having two or more characters in common, placed in juxta-position for the sake of convenience—how Rafinesque's two generic names can be ignored.

SCYLLIIDÆ.

Scylliorhinus, Blainville (1816).

22. S. maculatus, *Bl. Schn., sp.* North-western coast of Australia. Bramble Bay (*Brit. Mus.*). Port Darwin (*Macleay Mus.*). The genus *Scylliorhinus* having been established by Blainville in 1816, takes precedence of Cuvier's *Scyllium* by thirteen years, and must therefore be retained.

*23. S. ANALIS, *Ogilby, sp.* Port Jackson, and its vicinity (*Austr. Mus.*), common; the "Spotted Dog-fish." I have been unable to ascertain the northern limit of the range of this species, which is at a glance distinguishable from the preceding by the non-confluence of the nasal valves; it should, however, be compared with the Japanese *S. buergeri*, to which it seems to be nearly related. Mr. Johnston in his "Catalogue of Tasmanian Fishes" includes *S. maculatus*, and states that the "nasal valves are confluent"; this would of course be conclusive evidence as to the non-identity of the Tasmanian with my species, but as his short diagnosis is evidently taken word for word from Dr. Günther's catalogue description of the true *S. maculatus*—Mr. Johnston not having personally examined a Tasmanian specimen—I consider it highly probable that my species has been mistaken for the northern one.

24. S. LATICEPS, *Dum., sp.* Tasmania.

Note.—This Dog-fish has a very wide range in the Pacific, having been recorded as abundant in New Zealand waters (*Sherrin, Handbook of the Fishes of N.Z., p. 121*), and more recently from the Californian coast by Messrs. Jordan and Gilbert.

GINGLYMOSTOMA, Müller and Henle (1837).

*25. G. CONCOLOR, *Rüpp., sp.* Port Moresby, New Guinea (*Macleay*). In the British Museum Catalogue of Fishes, viii. p. 409, Dr. Günther mentions as adult an example which measures twenty-eight inches only, but he unfortunately omits to mention the sex of the specimen; I hardly think that the term "adult" can be correctly applied to this example, since a male from the Solomon Islands, in the collection of the Australian Museum, though measuring no less than sixty-six inches, is presumedly immature, the claspers being but little developed. Of course there is a possibility that the individual in question

may have sustained some injury which has resulted in a partial or even permanent arrest in the development of the sexual organs, which would at once account for the possibly abnormal decrescence in the size which these have attained in our specimen, and being barren, for its increased size.

STEGOSTOMA, Müller and Henle (1837).

*26. S. TIGRINUM, *Gmel., sp.* Cape York, Q. *(Austr. Mus.)*.

PARASCYLLIUM, Gill (1861).

27. P. VARIOLATUM, *Dum., sp.* Tasmania. As with the two succeeding species this Dog-fish appears to be individually scarce, since from his short note on the subject it does not seem that Mr. Johnston has ever met with a recent example. I think it highly probable that the cause of this apparent scarcity will be found to be due to the ordinary habitat of the genus being in deep water, or at least in water of such a depth as to exceed the limits to which the professional fishermen of these coasts confine themselves.

*28. P. COLLARE, *R. & O.* Outside Port Jackson, N.S.W., in seventy fathoms *(Austr. Mus.)*; *vide* P.L.S. N.S.W. iii. (2) 1888, p. 1310.

29. P. NUCHALE, *McCoy.* Port Phillip, Vic. *(McCoy)*, scarce.

CHILOSCYLLIUM, Müller and Henle (1837).

30. C. OCELLATUM, *Gmel., sp.* Port Jackson, N.S.W. *(Austr. Mus.)*, rare. North coast of Australia. Port Moresby, New Guinea *(Austr. Mus.)*, common. Richardson's *C. trispeculare* is merely a variety of this species.

*31. C. PUNCTATUM, *M. & H.* Port Darwin, North-western Australia *(Klunzinger)*.

32. C. MODESTUM, *Gnth.* East coast of Australia, common. The "Brown Dog-fish" of Port Jackson.

CROSSORHINUS, Müller and Henle (1837).

33. C. BARBATUS, *Gmel.*, *sp.* The "Carpet Shark" or "Wobbegong." Southern and eastern coasts of Australia, common. Tasmania, common *(Johnston).* Port Moresby, New Guinea *(Macleay).*

Note—Mr. S. Scudder (Zool. Nom., Univ. Index, p. 67) gives the orthography of the generic title as *Chrossorhinus*, but in this he is undoubtedly incorrect, as the first part of the word is derived from the Greek κροσσος a tassel—generally used in the plural in the sense of a fringe.

34. C. TENTACULATUS, *Ptrs.* Cape York, Q. (*Brit. Mus.*) Port Adelaide, S.A. (*Zietz*) ; examples from the latter locality are contained in the collections of the Australian Museum, Sydney, and of the South Australian Museum, Adelaide. Though very closely allied, the differences, should they prove constant, are sufficient to justify the separation of this from the preceding species. Taking the various characters mentioned in the description given by Dr. Günther seriatim, I find that the number of tentacles is inconstant, and this character therefore loses much of its value ; thus in our specimen there are on each side a single minute tentacle on the side of the throat directly under the upper angle of the spiracle, two rather larger a little above and behind the angle of the mouth ; a small one on the middle of the hinder section of the upper lip; a short broad strongly compressed lobe at the upper angle of the maxilla, and a similar lobe in the lower angle of the inter-maxillary cleft, and finally a narrow tentacle, equal in length to the spiracle, rises from the inner angle of the lingual flap; all these appendages are simple, whereas in *C. barbatus* the majority are as a rule bifid, and some occasionally trifid, while they are always

more numerous and of larger size. The second character brought prominently forward in Dr. Günther's description is the comparative distance between the dorsal fins, which is stated by him to be "equal in length to the base of the first dorsal" in *C. barbatus*, and "much less than the length of the base of either dorsal" in *C. tentaculatus*. This character is entirely fallacious; there is now before me a specimen of an undoubted *C. barbatus*, from Port Jackson, in which the intra-dorsal distance is quite as small as in our example of *C. tentaculatus*, being but little more than one-half of the length of the base of the first dorsal; and further among specimens of the former of both sexes and all sizes up to seven feet I have not found a single example in which the intradorsal space was even approximate in length to the base of the anterior dorsal. The colours are also very variable, and are probably similar in both forms, *C. barbatus* being as often as not broadly fasciated with brown. The characters therefore on which Drs. Peters and Günther rely for the specific separation of the two forms are thus proved to be inconstant, and so absolutely valueless from a scientific point of view. We have therefore to look for other characters by which to separate the two supposed species, and these I am unable to find, for if we except the slightly finer granulation of the epiderm, there is positively no character on which reliance can be placed. Our specimen, however, has very distinct hard tubercles on the dorsal surface forming either scattered patches or irregular longitudinal rows, as well as a crescentic row of much smaller ones above the eyes, a similar row between the orbit and the anterior gill-opening, and some scattered ones on the snout and cheeks. As, however, neither its describer nor Dr. Günther makes any reference to these tubercles it is probable that this is either an individual peculiarity—the varieties of *Chiloscyllium indicum* form a fairly parallel case—or was caused by the specimen having been left on

the pier† and so exposed to the weather for an indefinite length of time, which may have raised blisters which no stretching of the skin could eradicate. As I have examined only this one specimen in very bad condition it would be inexpedient for me to give an authoritative opinion as to the identity or non-identity of the two forms, but I feel pretty sure that a characteristic series of both would indubitably demonstrate their specific identity. Under the circumstances, however, this is merely an opinion founded on that single specimen, and has to be verified by the examination of a more extended series.

Note.—Dr. Peters could hardly have devised a more inappropriate specific name for this shark. In the first place all the members of the genus are furnished with tentacular appendages, and in the second place *C. barbatus* and *C. dasypogon*, both indubitably good species, are much more amply provided with these appendages, so that as a fact Dr. Peters' species instead of being *par excellence* the "Tentaculated Wobbegong," as its name would imply, is exactly the reverse.

*35. C. DASYPOGON, *Blk.* Torres Straits (*Austr. Mus.*)

HETERODONTIDÆ.

HETERODONTUS, Blainville (1816).

36. H. PHILLIPI, *Bl. Schn.*, *sp.* Coast of New South Wales, common at least as far north as Broken Bay, above which I have been unable to trace it, though it doubtless occurs. Coast of Victoria; Port Phillip, common (*McCoy*). South Australia (*Brit. Mus.*). Tasmania, "common in the Derwent and Tamar" (*Johnston*). For reasons given previously I am obliged to adopt Blainville's generic

† Found lying on the Semaphore Jetty about one year ago. It was caught by one of the fishermen, and thrown away as being useless (*Zietz*, *in lit.*).

name, it having a priority of a year over Cuvier's *Cestracion*, even were that name admissable, which as I have conclusively shewn (P.L.S. N.S.W., iii. (2) 1888, p. 1770), is not the case; for the same reason it would be absurd to continue to employ the commonly accepted family name *Cestraciontidæ*, and being unable to find an older name I have adhered to that used in my Catalogue of the Fishes of New South Wales, 1886.

37. H. GALEATUS, *Gnth.*, *sp.* Port Jackson, almost as common as *H. phillipi.* Port Stephens, N.S.W. (*Austr. Mus.*). These are the only localities whence we have ever received it.

Note.—For detailed accounts of this and the preceding species see Miklouho-Maclay and Macleay, P.L.S. N.S.W., iii. pp. 309, 313, pls. 22-25.

SPINACIDÆ.

ACANTHIAS, Risso (1826).

38. A. VULGARIS, *Rss.* Coast of Victoria (*McCoy*). Tasmania, very abundant (*Johnston*).

39. A. BLAINVILLII, *Rss.* New Holland (*Günther*). Tasmania, abundant (*Johnston*).

40. A. MEGALOPS, *Mcl.* Neighbourhood of Port Jackson, not uncommon, but rarely taken inside the Heads. This form, distinguished by the forward position of the ventral fins, is the only one I have met with here, and appears to be in many points intermediate between the two others; eventually it is probable that the three will have to be joined together under a common name.

ECHINORHINUS, Blainville (1816).

*41. E. SPINOSUS, *Gmel.*, *sp.* Portland, Vic. (*McCoy*). This is the only specimen as yet recorded from Australian waters.

ISISTIUS, Gill (1864).

42. I. BRASILIENSIS, *Q. & G.*, *sp.* Australia (*Kner*).

SQUATINIDÆ.

SQUATINA, Duméril (1806).

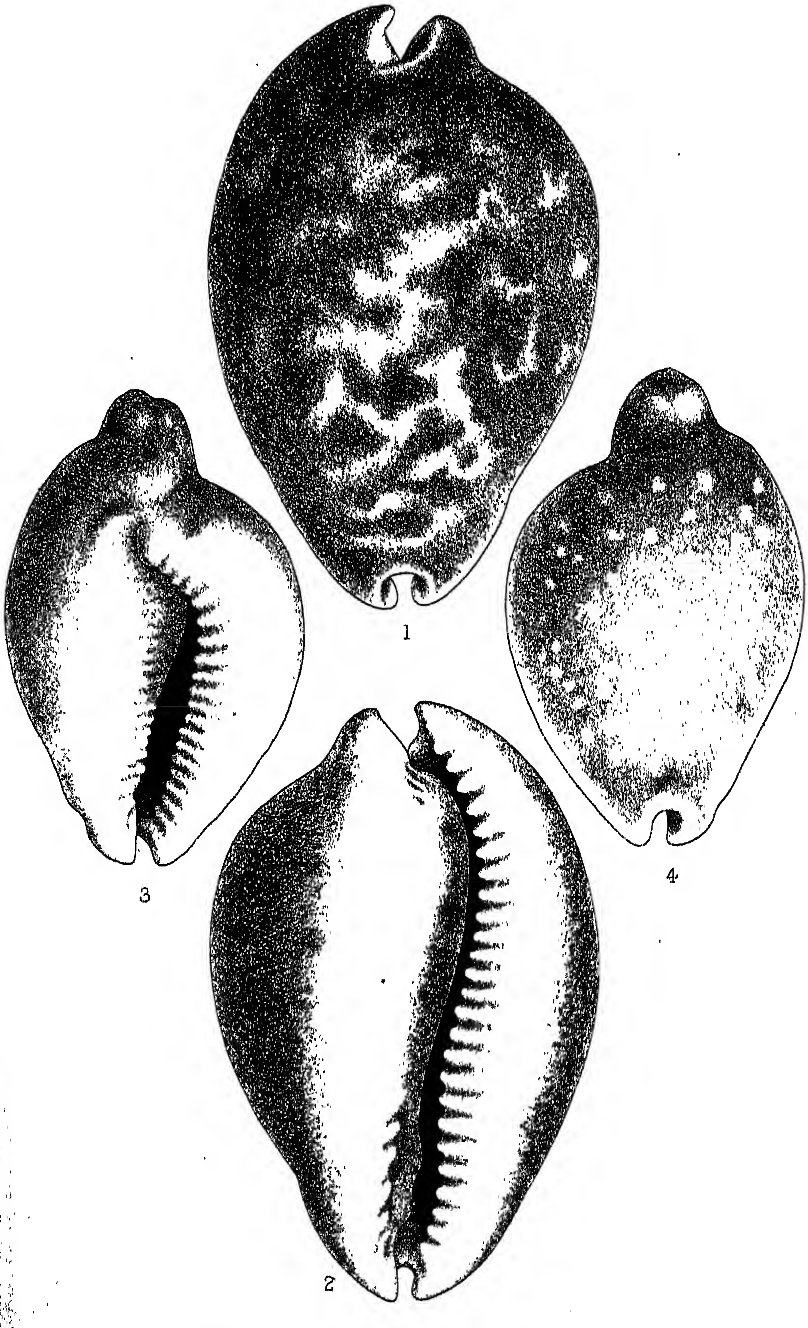
43. S. VULGARIS, *Rss.* New South Wales. Though it is doubtless found further north, I have not succeeded in obtaining any authentic information of its occurrence beyond the neighbourhood of Port Jackson, where, however, it is common. Victoria, "not very uncommon in Hobson's Bay and round our coast" (*Mc Coy*). Tasmania, common (*Johnston*). Variously known as the "Angel-fish," "Angel-Shark," or "Monk-fish." Klein's name, *Rhina*, having been published as early as 1745 becomes inadmissable, which is just as well since Olivier in 1807 gave the same appellation to a genus of coleopterous insects, for which it is still retained. Duméril's name therefore very properly stands.

PRISTIOPHORIDÆ.

PRISTIOPHORUS, Müller & Henle (1837).

44. P. CIRRATUS, *Lath.*, *sp.* New South Wales, northwards to Broken Bay, common. Tasmania, not common (*Johnston*). South Australia (*Brit. Mus.*). The "Saw-Shark."

45. P. NUDIPINNIS, *Gnth.* Hobson's Bay, Vic., very common (*McCoy*). Tasmania (*Johnston*). South Australia (*Zietz*). I agree with Messrs. McCoy and Zietz as to the very doubtful propriety of separating this from the preceding species.



(1. 2.) CYPRÆA VENUSTA Sow. Var. (3. 4) CYPRÆA VITELLUS Linn. Var.

J. M. Kennedy del. et lith. S. T. Leigh & Co Print

NOTE ON *CYPRÆA VENUSTA*, (SOWERBY).

By James C. Cox, M.D., F.L.S.

(Plate xv., figs. 1 and 2).

The specimen of *Cypræa venusta*, Sow., (= *C. Thatcheri*, Cox) from which the accompanying illustration was taken, was obtained at Cape Naturaliste, where it was washed on shore with the animal in it. It is 78 millimètres long and 52 wide. It is so unlike the type specimens that when first I saw it lying in a case of exhibits in the Melbourne Exhibition I mistook it for *Cypræa thersites*, having a view of its dorsal surface only, but a moment's handling of it at once revealed its nature, unlike as it was to the type. Its base is white gradually passing off to a granular grey at the sides with rather large undefined round dark spots showing through the grey sides, which are absent in my two type specimens of *C. Thatcheri*; the size of the teeth, their number and their character, however, in no way differ from them. The colour of the interior of the shell is of a darker purple than in my types; but the anterior and posterior notches are similar. It is on the lateral and dorsal aspects of the shell that the main differences exist, and these differences after all are only differences of colour,—the granular slate-coloured sides meet in front and behind, in front of the channels, and thus form a complete circle round the shell, and the dorsal surface enclosed is ornamented with very dark geographically bounded, variously shaped portions, mostly rounded with tapering offshoots, while the intervening spaces are of the normal bluish-amber colour of the type of *C. Thatcheri*; the dark geographically bounded portions are quite as dark as the dark dorsal markings of an ordinary *C. thersites.*

NOTES AND EXHIBITS.

Dr. Ramsay exhibited a live specimen of a beautiful snake, *Nardoa gilberti*, one of several caught and forwarded to him by Mr. James Ramsay, of Wattagoona, N.S.W., a gentleman who has largely contributed to the collections in the Australian Museum.

Mr. North read the following note:—"It may be interesting to know that several of the Gouldian finches have bred in Dr. Ramsay's aviary at the Museum. A pair, ♂ and ♀, of the black-headed phase hatched out on May 13th last (1888) three young ones, one of which, although having a dull-coloured breast, has developed the crimson head of *Poëphila mirabilis*. There can be now no doubt whatever that *P. gouldiæ*, the black-headed phase, and *P. armitiana*, the yellow-headed phase, are merely varieties of *P. mirabilis*, originally described by Hombron and Jacquinot in the "Voy. au Pôle Sud." Many specimens recently brought to Sydney show the various stages of plumage above-mentioned, bearing out Dr. Ramsay's previous statement respecting the various phases of plumage exhibited in this species."

Dr. Cox exhibited a large flat stone, 66½ centimètres long and 38½ broad at its widest part, used by the natives near Cooper's Creek, N.W. of Bourke, in New South Wales, as a mill stone for grinding the seeds of the Nardoo and also of the Pig-weed *(Portulaca oleracea)*, the latter being much cultivated by the natives in that district for the sake of the seeds, which are used as an article of food; the plant is grown on slightly raised mounds in the way pumpkins and melons are grown, and before the seed vessels are quite ripe and have opened, the whole plant is cut up, reversed, and dried in the sun; the seed vessels are then plucked off, and threshed or rather rubbed down, and the seed collected for grinding. The stone

is of a felspathic character, of a pale buff colour, and has a laminar structure, but the grinding surface is worn quite smooth and slightly concave by rubbing; the seed to be ground is laid on the stone and rubbed with a small piece of flat stone of a similar nature to the large one (two samples of these stones accompanied the exhibit). The stone is the property of Mr. Frank Hill, who has placed it in the exhibitor's hands for presentation to the Museum.

Dr. Cox also exhibited photographs of *Turbo Jourdani*, Kiener, showing the operculum *in situ*, and its inner side after removal from the shell, all natural size; and offered the following remarks. " As the specimen from which the operculum was taken contained it attached to the dead animal, there can be no doubt about its genuineness; it was obtained by my friend Mr. Irvine at Geographe Bay, Western Australia. The shell is about 14 centimètres long and 12½ wide, and has a decided *phasianella* aspect in colour and smoothness of surface; the operculum is 95 millimètres in its greatest diameter and 80 in the opposite, solid, ponderous, stony, white on the external surface and smooth; the reverse is flat, slightly excavated, and covered with a chestnut-brown epidermis; the spire is excentral in the long diameter, 25 mm. from the lower edge, and about 4 mm. to the right of the central line with the internal surface towards one. It weighs 7¾ oz. I have known of the existence of these opercula for many years, but have been unable hitherto to ascertain to what species of *Turbo* they belonged."

Also, a remarkable deformed example of *Cypræa vitellus*, Linn., from New Caledonia (Plate xv., figs. 3 and 4).

Mr. Skuse exhibited specimens of the pupa cases and imagines of *Batrachomyia nigritarsis* and *B. quadrilineata*, described in his paper.

Also some grass which had been kept dry for more than twelve months, and still contained the living larvæ of *Lasioptera*

vastatrix, Sk., showing how easily this destructive insect might be conveyed from one part of the country to another through the medium of hay.

Mr. Burnell exhibited specimens of Ceylon fire-flies.

Mr. Deane called attention to a means of distinguishing species of plants by qualities and products which are generally overlooked by botanists, but which are of the utmost practical value. Plants only slightly differing outwardly are put down as mere varieties of the same species. Inquiry, however, perhaps shows that their products, such as timber, are quite different in character, in which case, therefore, they ought to be recognised as quite distinct in species. Mr. Deane exhibited timber specimens of three so-called varieties of *Eucalyptus saligna*, the Sydney blue gum, two of *E. hœmastoma*, and two of *E. goniocalyx*, to illustrate his remarks.

Mr. Macleay exhibited two new species of Snakes which he had received from J. A. Boyd, Esq., of Ripple Creek, Herbert District, Queensland. One was evidently a species of *Fordonia*, a genus of freshwater snakes of the family Homalopsidæ; the other was a sea-snake, resembling somewhat the Hydrophidæ, but probably belonging to the genus *Chersydrus*, one of the Wart Snakes or Acrochordidæ.

Mr. Trebeck made the following communication :—

"The Committee of the Field Naturalists' Section of the Royal Society of South Australia have applied for the co-operation of our Society in their endeavours to establish the better protection of the native fauna and flora. This opens up a most difficult question, as many of the animals and birds proposed to be protected are included in the list of noxious animals under the 'Pastures and Stock Protection Act' now in force in this colony, and it is to the interest of pastoralists to keep the numbers down, if not to exterminate them.

"Kangaroos and wallabies form the largest numbers of these native noxious animals, and when it is admitted that a full-grown kangaroo eats as much grass as six sheep, it is patent that a grazier, who pays either a heavy rent to the crown, or possibly a large amount of interest to his banker, cannot afford to keep animals that will not give him steady and reliable annual returns like sheep and cattle.

"It may be interesting to state that in 1887 and 1888 the collective reports of the various stock inspectors showed that the estimated numbers in those years were :—

1887—Kangaroos............	1,881,510
1888— do.	1,170,380
	Decrease—711,130.

Showing a considerable decrease.

1887—Wallabies............	2,742,550
1888— do.	3,185,400
	Increase—442,850.

Showing a good increase, although the number killed that year was 694,702.

"The wallabies are very troublesome and would soon overrun and destroy all portions of country near which there is the least cover or shelter for them. The bonuses paid for their destruction range

For Kangaroos............from 2d. to 1s. 6d. per head.
For Wallabies.............from 1d. to 1s. per head.

"Good kangaroo skins realise from 3s. 6d. to 10s.; good wallaby skins from 9d. to 3s. apiece.

"With reference to the letter of Mr. Solomon, which the Adelaide Committee have sent, and in which that gentleman suggests that a heavy fine should be inflicted on persons killing

kangaroos whose marketable skins would not weigh $\frac{10}{12}$lb, I fear that for the reasons given above no legislation is possible so long as the kangaroos and wallabies remain so numerous and eat so much food which can be better and more profitably utilised.

"With the permission and aid of the Trustees an active Committee might use our National Park for the preservation of very many members of the fauna and flora, and thus help our Adelaide friends in their praiseworthy attempts to preserve the many interesting animals and birds which belong to our country."

Mr. Trebeck exhibited a specimen of Eucalypt bark regularly marked by the burrows of some insect.

WEDNESDAY, 24TH APRIL, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

Mr. C. I. K. Uhr, and Dr. Cobb were present as visitors.

The President made the following announcements:—

(1) That Mr. Henry Deane had deposited with the Society on loan his valuable collections of Australian and other seaweeds, which had been collected and named by the late Dr. Harvey.

(2) That there would be no Excursion in May.

DONATIONS.

"Zoologischer Anzeiger." XII. Jahrg., Nos. 300-302 (1889). *From the Editor.*

"Entomologisk Tidskrift." Arg. IX. (1888). *De la part de la Société Entomologique de Stockholm.*

"Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Universitá di Torino." Vol. III., Nos. 49-52 (1888), and one plate. *From the Museum.*

Mémoires de la Société des Naturalistes de la Nouvelle-Russie, Odessa." Tome XIII., Part 2 (1888). *From the Society.*

"Bulletin of the American Geographical Society." Vol. XX., Supplement (1888). *From the Society.*

"The American Naturalist." Vol. XXIII., No. 265 (January, 1889). *From the Editors.*

"The Canadian Record of Science." Vol. I., Nos. 1 & 2; III., No. 4 (1884-88). *From the Natural History Society, Montreal.*

"The Quarterly Journal of the Geological Society of London." Vol. XLV., Part 1 (No. 177), 1889. *From the Society.*

"The Pharmaceutical Journal of New South Wales." n.s. Vol. II., Part 4 (April, 1889). *From the Editor.*

"The Victorian Naturalist." Vol. V., No. 12 (April, 1889). *From the Field Naturalists' Club of Victoria.*

"Annales de la Société Géologique de Belgique." Tomes XIII.; XIV., Liv. 1; XV. (1887-88). *From the Society.*

"Acta Societatis pro Fauna et Flora Fennica." Tomes III. and IV. (1886-88); "Meddelanden af Societas." XIV. Häftet (1888). *From the Society.*

"Systematic Census of Australian Plants, &c." By Baron von Mueller, K.C.M.G., M. & Ph.D., F.R.S. Fourth Supplement (for 1886, 1887 & 1888). *From the Author.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CVIII., Nos. 1-4 (1889). *From the Academy.*

"Proceedings of the Royal Society of London." Vol. XLV., No. 273 (1888). *From the Society.*

"Sur le Gulf-Stream—Recherches pour établir ses Rapports avec la Côte de France: Campagne de l'*Hirondelle*, 1885." Par S. A. le Prince Albert de Monaco. Also eight Pamphlets on various subjects in connection with the Voyage of the Yacht "Hirondelle" by the same author. *From the Author.*

"Feuille des Jeunes Naturalistes." No. 221 (March, 1889). *From the Editor.*

"Videnskabelige Meddelelser fra Naturhistorisk Forening i Kjöbenhavn for Aaret 1888." *From the Society.*

"The Gold-Fields of Victoria—Reports of the Mining Registrars for the quarter ended 31st December, 1888." *From the Secretary for Mines, Melbourne.*

"Proceedings of the Royal Society of Queensland, 1889." Vol. VI., Part 1. *From the Society.*

"Report of the Auckland Institute and Museum for 1888-89." *From the Institute.*

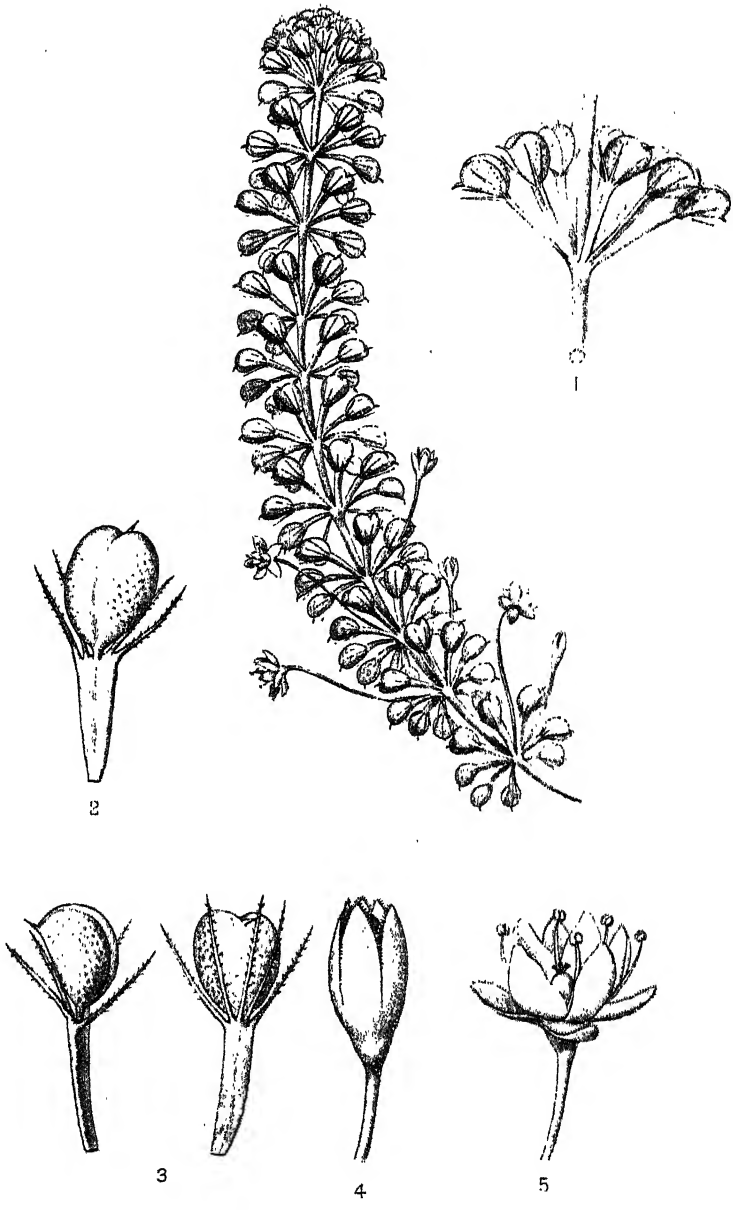
"Verhandlungen des naturhistorischen Vereines der preussischen Rheinlande und Westfalens." Folge 5, Jahrg. V. Zweite Hälfte (1888). *From the Society.*

"Journal of the Royal Microscopical Society, 1888." Part 6a (December); 1889, Part 1 (February). *From the Society.*

"Annalen des k.k. naturhistorischen Hofmuseums (Wien)." Band III., Nos. 3 and 4. *From the Museum.*

"Records of the Geological Survey of India." Vol. XXII., Part 1 (1889). *From the Director.*

"The Insect Fauna of Lord Howe Island." (Pamphlet.) By A. Sidney Olliff, F.E.S. *From the Author.*



R. Graff del. ALDROVANDA VESICULOSA Linné. *Baron & Gatward lith.*

NOTE ON THE PROBABLE OCCURRENCE OF *ALDROVANDA VESICULOSA* IN N.S.W.

BY BARON VON MUELLER, K.C.M.G., M.D., PH.D., F.R.S.

(Plate XVI.)

In the year 1747 a highly remarkable aquatic plant was discovered in Italy, and described by Monti, then Professor at Bologna, namely, the *Aldrovanda vesiculosa.* Long afterwards it was found in Bengal, then in the south of France, later in Austria, south-western Russia and Prussia. Suddenly and quite unexpectedly, in 1867, the plant was gathered in a swamp near Rockhampton, Queensland, by the late Mr. P. O'Shanesy; thus it is but reasonable to suppose that it may yet be found in many other places in Australia; but it is apt to escape notice, being usually entangled among other water-plants. Indeed I found fragments of *Aldrovanda* among dried specimens of *Utricularia vulgaris,* gathered in Silesia at the commencement of the century, the collector never observing the prize which had come within his reach. To draw prominently attention to this most curious weed, a lithographic illustration is prepared now for Australian use; and the advice is given, when lakes, swamps or river-bends are raked for floating or submerged plants, to watch also for fragments of *Aldrovanda.* It seems shy in flowering; but the petals, when developed, are rather conspicuous and white. At Calcutta the plant occurs also in "salt pans;" but Dr. Roxburgh already found it there in fresh waters also, alike to its ordinary occurrence elsewhere. Ripe fruits seem seldom to have been obtained. The plant soon becomes rootless, moving free about. The folded but vesicular-turgid, transparent and irritable lamina of the leaves catches (and perhaps digests)

minute aquatic animals. The stigmas, when the flower rises to the surface, obtain the pollen through the action of insects (Schenk). Irrespective of seedlings, the plant hibernates from leaf-buds (Leiboldt). Vascular bundles in the leaves are wanting (Oels). *Aldrovanda,* as a genus, differs solely from *Drosera* in its vegetative organs, the external aspect being much that of *D. stolonifera* from West Australia; and here it should also be remarked, that the great differences exhibited in habitual respect and leaf-organisation by species of *Utricularia* count not as of generic value, *U. stellaris* being even provided with a whorl of turgid float-organs under the raceme, consisting of metamorphosed leaves.

EXPLANATION OF PLATE XVI.

Aldvovanda vesiculosa.

Fig. 1. A whorl of leaves.

Figs. 2 and 3. Separate leaves.

Fig. 4. Flower unexpanded.

Fig. 5. Flower expanded.

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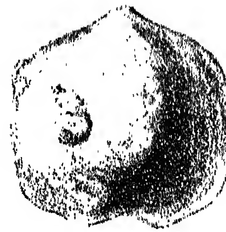

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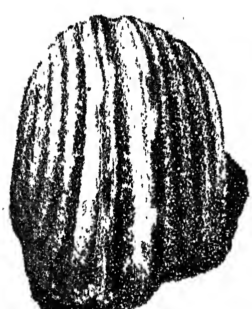

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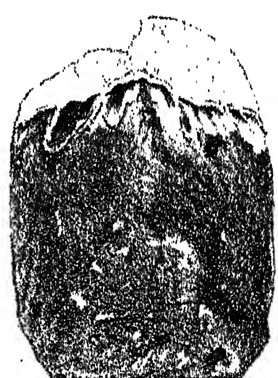

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Baron & Gatward del. et lith.

REMARKS ON FOSSILS OF PERMO-CARBONIFEROUS AGE, FROM NORTH-WESTERN AUSTRALIA, IN THE MACLEAY MUSEUM.

By R. Etheridge, Junr.

Palæontologist to the Australian Museum, and Geological Survey of New South Wales.

(Plate XVII.)

Introduction.—At a meeting of this Society, held in April, 1888, the Hon. W. Macleay exhibited some fossils from the neighbourhood of Derby, North-western Australia. They are contained in a sandy ferruginous rock, and are said by Mr. Froggatt, who collected the specimens, to come from a small area mapped by the late Mr. E. T. Hardman,* as a portion of his Pindan Sands. The position indicated by the collector on the chart in question coincides with a portion of Hardman's Pindan Group. The latter regarded these deposits as of Tertiary age, and distinctly states that they proved to him unfossiliferous.

Great, therefore, was my surprise to find the organic remains exhibited clearly of a Carboniferous facies. Mr. Macleay was kind enough to allow me to have the loan of the specimens in question, with others from neighbouring localities, in the latter case unquestionably from the great Carboniferous area of the Napier Range, as mapped by Mr. Hardman, and obtained by Mr. Froggatt during the same visit. The full list of localities is as follows :—

* First and Second Reports on the Geology of the Kimberley District, Western Australia, by Edward T. Hardman. *W. Australia Legislative Council Papers*, 1884, No. 31; *Ibid.* 1885, No. 34. Perth, 1884-85 (Government Printer).

(1) Ironstone Ridge, twenty-five miles south-east of Yeeda Station, on the Fitzroy River.
(2) Mount Marmion, near the junction of the Lennard and Meda Rivers.
(3) Mount North Creek, Napier Range.
(4) Lennard River Gorge, Napier Range.
(5) Barrier Range Homestead, Napier Range.
(6) Oscar Range, north-east side.

Before proceeding to a description of the organic remains, a short sketch of the Pindan Sands and of the recognised Carboniferous beds, extracted from Mr. Hardman's Reports,* will not be out of place.

(1) The Pindan Sands and Gravels are the youngest of the Geological formations in the Derby area, excepting, of course, recent alluvial deposits, and were provisionally called by Hardman, Pliocene. They were termed "Pindan"—"from principally occurring in the thickly wooded undulating country termed by the natives 'pindan.'" These beds consist of reddish sands with pea-like nodules of ironstone, gravels, coarse conglomerate, grits and sandstones, the result of the consolidation of detrital deposits by carbonate of lime, or ferruginous material. There are no good sections, but these beds are known to be from twenty to thirty feet thick. About ten miles south of the Yeeda Station where they attain this thickness, these sands and gravels rest on "coarse sandstone, probably of Carboniferous age." No fossils were found in the Pindan beds by Mr. Hardman, "but there can be little question that they are of comparatively recent age. I have classified them provisionally as belonging to the Pliocene period."† Mr. Hardman further added that thick beds of consolidated ironstone conglomerate were associated with the sands and gravels in places, often assuming the form of low, flat-topped, and conical hills.‡

* *Op. cit.* pp. 7 & 9 and 14 & 15, respectively.
† First Report, 1884, No. 31, p. 8.
‡ Second Report, 1885, No. 34, p. 14.

With regard to the area occupied by these rocks, it is a considerable one. Starting from Roebuck Bay on the west, a narrow band has been traced eastward to the mouth of the Fitzroy River in King Sound, extending north-westwards to and beyond the mouths of the May and Meda Rivers. Thence towards the south-west the Pindan Sands and Gravels occupy the whole of the country between the Fitzroy and Lennard Rivers as far as the Napier, Oscar, and Prince Leopold Ranges, which are composed of Carboniferous limestone and metamorphic rocks. Throughout this area are dotted the remains of a Carboniferous formation—the division (*b*) of the next paragraph—as isolated hills of sandstones, grits and conglomerates,* which apparently crop up through the Pindan beds.

(2) The Carboniferous Formation, as recognised by Mr. Hardman, occupies an immense area in the Kimberley district, and consists of two subdivisions—(*a*) an upper or Sandstone Series, and (*b*) a lower or Limestone Group. The former is a yellowish-reddish freestone, and of it many of the most prominent mountain ranges are formed, such as the Grant Ranges, the St. George Ranges, and Mount Anderson. "It may reasonably be asserted that this sandstone formation is considerably over 1000 feet in thickness." Again, the author adds: "And although in great part hidden by the newer deposits described above, it is certain that it extends from near the sea-coast, as at Roebuck Bay, for a distance of 190 miles into the interior. . . . Numerous exposures of the sandstone rocks are seen to emerge from the alluvial and pindan coverings." In the Lennard River area, Carboniferous plants were found in these beds, but no marine fossils.† On the contrary, on the Fitzroy River the sandstones proved very fossiliferous, the organic remains, as listed by Mr. Hardman, being characteristic Carboniferous Limestone species.‡ The second subdivision (*b*), or Carboniferous Limestone in the

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* First Report, 1884, No. 31, map.
† First Report, 1884, No. 31, p. 8.
‡ Second Report, 1885, No. 34, p. 16.

Kimberley district, is of large extent, and in it are comprised Nos. 2-6 of the above localities. It is a light-coloured magnesian limestone interbedded with thick layers of shale, and thin arenaceous bands usually fossiliferous, the list given by Hardman being well-known Carboniferous Limestone species. It comprises within its area the Napier, Hull, Rough, Oscar, and other ranges.* The sum of Mr. Hardman's explorations went to show that "there are wide-spread deposits of Carboniferous rocks in Western Australia, although, even within the last few years, this has been doubted."†

We may now consider the localities yielding the two sets of fossils *seriatim.*

Ironstone Ridge and its Fossils.—From this locality Mr. Froggatt has collected a sandy ironstone crammed with fossils, which weather out in a peculiar state of preservation, and from their crowded nature it is difficult to sufficiently individualise specimens for description. Mr. Froggatt informs me that this ridge is about seven miles long, and from thirty to forty feet above the surrounding country. It is composed of horizontally bedded ironstone. The organic remains are essentially Permo-Carboniferous in age, answering to those of our Lower and Upper Marine beds in the New South Wales coal-bearing series. Ironstone Ridge is not shown on Hardman's map, but other parallel, and most probably similar, ridges are near, such as Grant Range and Mount Anderson, the latter being described as composed of "red and white sandstone, with flaggy ironstone on the summit." These ridges evidently crop through the Pindan Sands which were deposited round them, and it is therefore easy to understand that where not specially marked on the map they might be mistaken for a portion of the Pindan Series.

The following are the species discernible:—

* First Report, 1884, No. 31, p. 9.

† Second Report, 1885, No. 34, p. 17.

BRACHIOPODA.

Genus PRODUCTUS, *J. Sowerby.*

PRODUCTUS BRACHYTHÆRUS, *G. B. Sowerby.*

P. brachythærus, G. B. Sby., in Darwin's Geol. Obs. Volc. Islands, 1844, p. 158; Morris, in Strzelecki's Phys. Descrip. N. S. Wales, &c., 1845, p. 284, t. 14, f. 4^c (*non.* f. 4^b).

Obs.—Both a ventral and dorsal valve are present which appear to represent this protean shell. The dorsal valve is of a much more quadrate shape than the ventral, and belonged to a larger individual. It is covered by closely set spine bases, which both on this and on the ventral valve forcibly remind one of D'Orbigny's figure of this species in Dumont D'Urville's work.* The ventral valve also has an unmistakable resemblance to the forms figured by Dr. Waagen as *Productus Abichi* and *P. serialis.*† This resemblance lies in the elongated tear-like spines distributed over the surface and the median sulcus. I have seen a similar variety from Queensland.

P. brachythærus is widely distributed throughout the marine beds of the Coal Measures of N. S. Wales, Queensland, and Tasmania.

PELECYPODA.

Genus AVICULOPECTEN, *McCoy.*

AVICULOPECTEN TENUICOLLIS, *Dana, sp.*

Pecten tenuicollis, Dana, in Wilkes U.S. Explor. Exped. Vol. X. Geol. p. 705, Atlas, t. 9, f. 7.

Aviculopecten tenuicollis, Etheridge fil., Cat. Australian Foss. 1878, p. 67.

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* Voy. au Pole Sud, &c. Géologie, Atlas, t. 9, f. 6 and 7.

† Pal. Indica (Salt Range Foss.), 1884, I. pt. 4, fasc. 4, t. 74, f. 1-7, f. 8.

Sp. char.—Shell of median size, practically equilateral, higher than wide, hinge line apparently as wide as the shell; valve, seemingly the right, faintly convex, with rather large triangular ears, the anterior slope abrupt and steep; umbo well marked and prominent; surface bearing from twenty to twenty-two radiately curved, coarse, or rough-looking entire costæ, with a smaller interpolated rib separating each pair, and hardly reaching the umbo; the whole crossed by growth laminæ, the primary costæ apparently becoming spinous at the points of intersection.

Obs.—The principal characters of this species are its shape, the number and arrangement of the costæ, and the steep anterior slope above the anterior ear. On the whole, it appears to correspond with the above little-recognised species, but which, I have reason to believe, is much more common in the Permo-Carboniferous beds of N. S. Wales than is generally supposed.

Genns PETERINEA, *Goldfuss.*

PTERINEA MACROPTERA, *Morris.**

P. macroptera, Morris, in Strzelecki's Phys. Descrip. N. S. Wales, &c., 1845, p. 276, t. 13, f. 2 & 3.

Obs.—A single example, much defaced by a peculiar fused or semi-enamelled appearance common to most of the fossils from Ironstone Ridge, possesses many of the characters of this species, such as the convex body, large posterior wing, coarse concentric rugæ, and well-marked ribs. The anterior margin, however, is rather defective, and in consequence the characteristic curve of the projecting anterior end is not visible. I think it may be regarded as a small individual of this species. It measures 2 inches by 1¼.

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* This species has no real relation to the genus *Pterinea* as now restricted. It will shortly be published by the writer as the type of a new genus *Merismopteria*.

Genus PARALLELODON, *Meek and Worthen.*

PARALLELODON SUBARGUTA, *De Koninck.*

Palæarca subarguta, De Koninck, Foss. Pal. Nouv. Galles du Sud, 1877, pt. 3, p. 287, Atlas, t. 16, f. 8, 8[a].

Obs.—Several small shells appear to correspond with De Koninck's description of this species, but I am unable to compare the interior characters. The shell is suboval, with a rather obliquely truncated posterior end, an inflated body, inconspicuous umbones, and rather distant growth laminæ.

Genus EDMONDIA, *De Koninck.*

Obs.—A single valve, much embedded in matrix, may possibly belong to this genus. It is short and rotund, and has the general outward appearance of the *Edmondiæ.* The concentric ornament of the shell is, however, rather coarse for this genus, and reminds us rather of that of *Pachydomus.*

GASTEROPODA.

Genus MOURLONIA, *De Koninck.*

MOURLONIA HUMILIS, *De Koninck.*

Pleurotomaria humilis, De Koninck, Foss. Pal. Nouv. Galles du Sud, 1877, pt. 3, p. 325, Atlas, t. 23, f. 14.

Sp. char.—Shell depressed conical, of five or six whorls; the body whorl enlarging but slowly until near the mouth; band moderately wide but not deep, with thread-like bounding carinæ, becoming quite sutural on the older whorls; inner lip a little reflected; umbilicus small.

Obs.—*Mourlonia* is a conical or discoid section of the older genus *Pleurotomaria*, usually with a large and deep umbilicus. The band is persistent, placed near the suture, in the form of a groove, and bounded by two keels. The present shell fulfils all these conditions, except that the umbilicus is small.

The portion of a shell figured by De Koninck under the above name closely resembles the specimens from north-west Australia, the form being very close indeed, and the appearance of the band identical.

Genus EUPHEMUS, *McCoy*.

EUPHEMUS ORBIGNII, *Portlock*, var.

Bellerophon d'Orbignii, Portlock, Geol. Report, Londonderry, &c., 1844, p. 401, t. 29, f. 12.

Euphemus d'Orbignii, de Koninck, Faune Calc. Carb. Belgique, 1883, pt. 4, p. 156, t. 42, f. 10-12; t. 42^{bis}, f. 5-7; t. 43, f. 9-12.

Obs.—By far the commonest shell amongst the Ironstone Ridge fossils is a *Bellerophon* of the group *Euphemus*. In the present altered state of the specimens I cannot distinguish it from the above species. The shell is globular, with a reniform aperture, devoid of a keel, covered with distinct and separate spiral ridges, which are obliterated on the back of the youngest portion of the body whorl, whilst the umbilicus is very small and pit-like.

Although to some extent resembling the allied species *E. Urei*, Fleming, sp., the discernible characters are, on the whole, more those of Portlock's shell.

Associated with the individuals of this species are a few others on which faint traces of transverse decussating striæ are visible, and one exhibits a tendency to a reflected callous inner lip. It is possible that these may be distinct from those referred to *E. Orbignii*.

Mount Marmion, with its Fossils.—The patch of which this hill forms a portion is described by Mr. Hardman as formed of "hard sandstone, ironstone, and grits," and is an elongated outcrop of strata surrounded by Pindan beds, and the alluvial matter of the above rivers. By the colouring of the map this is certainly a part of Hardman's Upper or Sandstone Series. The hill,

Mr. Froggatt says, is flat-topped, and consists of ironstone, which is to some extent in accord with the former description. The fossils were obtained from a calcareous sandstone on a small spur running out from the foot of the hill.

The fossils from this locality are exceedingly interesting, both from the fact of their coming from an horizon where only plants had been previously observed, and also from their close correspondence with others from a fossiliferous locality further to the south in Western Australia. The species are :—

ACTINOZOA.

Genus STENOPORA, *Lonsdale.*

Obs.—Several fragments of a Monticuliporid coral with wrinkled corallites is present in one of the blocks, but they are too closely embedded to enable a microscopic examination to be made. Sections prepared for the microscope display the features of *Stenopora* in the presence of the moniliform walls of that genus. The corallum appears to have been that of a delicate branching-lobate species, the branches having a width of three millimètres, but immediately before bifurcation the width is increased to six millimètres. The corallites in the axial portion of the corallum are polygonal, with delicate walls.

Genus EVACTINOPORA, *Meek and Worthen.*

Obs.—This genus has previously been recorded from Western Australia by Mr. W. H. Hudleston, who described two species from the Gascoyne Range, viz., *Evactinopora crucialis* and *E. dendroidea.* With regard to the specific separation of these I have some doubt, but amongst Mr. Macleay's specimens is an example partaking of the characters of that called *E. crucialis.*

The specimens originally consisted of the two opposing sides of one of the rays of the shuttle-shaped corallum seen on the weathered surface of the matrix. The structure is very badly

preserved, and adds nothing to that already known. The tubes and superimposed layers are visible, but the dividing lamina separating the two halves of the ray is not so.

The occurrence of *Evactinopora* is interesting as furnishing a fossil in common between the Mount Marmion and Gascoyne beds.

BRACHIOPODA.

Geuus SPIRIFERA, *J. Sowerby*.

Obs.—Two species of this genus are present in the Mount Marmion gatherings. The first is represented by fragments only, clearly those of a very large species, evenly and finely costate. One of the pieces is three and a quarter inches in depth from the hinge towards the front. Of the second species only one specimen is present, and although differing from the typical figures* must, I think, be referred to *Spirifera tasmaniensis*. It is a ventral valve, bearing six principal radiating costæ, three on each side the sinus. These, as well as the valleys between them, are traversed by fine and much smaller subsidiary ribs, and there are traces of transverse or concentric laminæ. The sinus, which is wide and open, likewise bears similar riblets. The general form of the shell is transversely oval.

Genus ATHYRIS, *McCoy*.

ATHYRIS MACLEAYANA, *sp.nov.*

Sp. char.—Shell circular, or transversely oval in outline, but usually the former, plano-convex, or at times slightly concavo-convex; the dorsal valve always convex, the ventral valve flat or slightly concave; the lateral margins are in the same plane with the hinge line, but the front is to some extent sinuated. Ventral valve flat as a rule, and very shallow, with an inconspicuous horizontal and semi-truncate umbo, but in no degree overhanging the hinge line; foramen small, circular, opening upwards, but

* Strzelecki's Phys. Descrip. N.S. Wales, &c., 1845, t. xv.

sometimes a little oblique; sinus very faintly shown on the surface of the valve, but indicated by a forward extension of the front margin. Dorsal valve moderately convex, evenly rounded in outline, with little or no distinction into fold and flanks; umbonal region far more marked than in the ventral valve. Surface of both valves with coarse, concentric, roughened laminæ.

Obs.—A very peculiar form of *Athyris*, from the persistent shallowness of the united valves, especially of the ventral. Ordinarily in this genus the valves are equally convex, or the ventral valve is the more so, the perforated umbo of the latter overhanging that of the dorsal valve. There is also a sinus in the ventral, and a fold more or less developed in the dorsal. In *A. Macleayana* some of these characters are reversed, thus:—the ventral valve is almost flat, except just at the front margin, the latter being bent upwards, and so representing the sinus. There is no fold in the dorsal valve, but it is moderately convex, and there is a sinuated front margin to some extent. The umbo of the ventral valve does not curve over that of the dorsal as in most species of *Athyris;* but, on the contrary, what little umbo there is to that valve is to some extent truncated, and the foramen is practically at right angles to the hinge line, instead of opening in the same plane. From this arrangement the foramen appears to open upwards, and is inconspicuous. In other words, the ventral valve fits on to and against the dorsal; and when the united valves are held in a direct line, and on the same level with the eye, from the dorsal side the foramen is not visible. These characters are constant in all specimens examined by me, and are so contrary to the general features in *Athyris* that I feel obliged to separate this curious shell as a distinct species. It affords me, therefore, much pleasure in associating with it the name of Mr. Macleay, to whom I am indebted for an opportunity of describing these interesting fossils.

In one or two places the appearance of the concentric surface laminæ would lead to the belief that they projected as separate spines, after the manner of *Athyris Roysii*, Lev.

Genus CYRTINA, *Davidson.*

CYRTINA CARBONARIA, *McCoy*, var. AUSTRALASICA, *var. nov.*

Pentamerus carbonarius, McCoy, Ann. Mag. Nat. Hist. 1852, X. p. 426.

Pentamerus carbonarius, McCoy, Brit. Pal. Foss. 1855, fas. 3, p. 442, t. 3d, f. 12-18

Cyrtina (?) carbonarius, Davidson, Mon. Brit. Carb. Brach. 1858, pt. 2, p. 71, t. 15, f. 5-14.

Sp. char.—Shell elongately oval, longer than wide, constant in shape, straight-sided, rough. Valves bi-convex, or in some cases nearly plano-convex, the ventral valve being much arched. Hinge shorter than the width of the shell. Ventral valve inflated, very convex; beak strongly incurved, overhanging the area which is concave, broad, and wide; sinus well marked, but narrow, and more or less angular; fissure large. Dorsal valve either nearly flat, or slightly convex; mesial fold low; umbonal region flattened from above. In the interior the septum of the ventral valve is more than two-thirds its entire length. Surface of the ventral valve rugged, bearing a few (four or five) thick, coarse, hardly radiate and prominent arched ribs, but usually indistinctly sub-divided, or split, especially the pair bounding the sinus, and all separated by angular interspaces; the bottom of the sinus occupied by a single rib.

Obs.—This truly British Carboniferous type is another important form in the West Australian extinct fauna, and is exceedingly like the shell found in the Northern Hemisphere, but possesses a greater degree of regularity and less variation. It resembles the later figures of Davidson, rather than the earlier ones of McCoy. Although the genus has before been recorded from New South Wales, I am not aware that this specific type has been met with. The oval, almost egg-shaped outline, and coarse angular ribs give the shell a very marked appearance.

The septum of the ventral valve, when exposed by fracture, is well shown, and is narrower in proportion than that of *C. carbonaria*, and without its abrupt forward termination, the decrease being much more gradual, and the inner ridge more or less sigmoidal. The dental plates are also shorter, and do not graduate into the septum as in *C. carbonaria.*

McCoy describes the shell as punctate, but Davidson makes no remark on the subject. In the present specimens it is impunctate. The interior details of the dorsal valve are wanting, and in consequence it is impossible to throw any further light on its relation to *Pentamerus* than the late Dr. Davidson did.

Genus PRODUCTUS, *J. Sowerby.*

Obs.—It is always unfortunate when the palæontological appetite is incited by promising material of a limited nature. Such is the case with the dorsal valve of a large *Productus*, measuring $3 \times 3\frac{1}{4}$ inches. The interior is exposed, displaying a large and prominent septum, and a remarkably straight hinge line. From the inner contour of the valve it is quite apparent that the outer was flatly concave. The dendritic adductor impressions are well shown, but still more remarkable are the deep long channels of the spine bases, visible not only on the sides, but over the general front surface of the valve. It is difficult, and somewhat hazardous to speak as to specific identity on such a specimen as this, but it may be *P. subquadratus*, Morris, or *P. scabriculus*. The former is met with in the rocks of the Mount Britton gold-field, North Queensland, but as a rule the dorsal valves are deeper and not so wide.

PELECYPODA.

Genus PACHYDOMUS, *Morris.*

Obs.—The greater portion of the right valve of a species allied to *Pachydomus globosus*, Sby., sp., but probably possessing a smoother shell. As regards size, its dimensions are small when

compared with the above massive species, which is the type of the genus. *Pachydomus* is exceedingly characteristic of the Permo-Carboniferous beds in Eastern Australia.

Napier Range Localities.

Mount North Creek.—At this locality, a creek running into the Lennard, a white and red streaky limestone was collected. It contains the indistinct remains of shells; one appears to be a Brachiopod, perhaps even a *Spirifera*, otherwise it is not nameable.

Lennard River Gorge.—A coarse siliceous and micaceous grit, forming "sandstone bars" in the limestone bed, contains a univalve very near to *Straparollus*. Three whorls are visible, without ornament or other distinguishing feature.

Another block contains very small valves of a Brachiopod, with the general outline of the ventral valve of *Rhynchonella pleurodon;* and another shell with much coarser and more obtuse ribs, with a punctate shell structure. The latter may be either *Retzia* or *Spiriferina.*

A third hand-specimen of siliceous grit exhibits six corallites of a medium-sized Rugose coral protruding from its surface, and partly seen in section, grouped together, but there is no evidence to show that they were fasciculately united. The corallites are circular, with about twenty simple septa projecting into the calices for about two-thirds of their width. The septa converge towards the centre and partially unite, leaving a small tabulate median area. The interseptal loculi are sparsely subdivided by dissepiments, becoming rather closer towards the middle of the corallum.

The general facies of this coral is to some extent that of *Diphyphyllum*, and to some that of *Zaphrentis.* In the absence of additional material for extended microscopic examination, it is provisionally referred to the former.

Conclusion.—It has been shown that throughout the Pindan Sands and Gravels, there protrude isolated hills and ridges, which were believed by Hardman, from their associated fossil plants, to be Carboniferous. Ironstone Ridge is evidently a similar hill, and not a portion of the Pindan Series at all, the latter resting on the flanks and filling up the hollows between the Carboniferous prominences. This view is, I believe, borne out by an expression of Hardman's, to the effect that "about ten miles south of the Yeeda station it" (*i.e.*, the Pindan,) "is 30 feet thick, and rests on coarse sandstone, probably of Carboniferous age."* Here we have the sandstone forming the bed-rock, and it is of course possible that it may extend under the Pindan deposits, where denuded away before their deposition. That the fossiliferous beds at Ironstone Ridge form a portion of the Upper or Sandstone Series, is again borne out by the fact that further south in the Fitzroy district, the place of the plants in this sandstone is taken by a copious marine fauna.† This point is an exceedingly interesting one, for again further south, a similar fauna has been shown to exist in the basin of the Gascoyne River, by Mr. W. H. Hudleston,‡ the fossils of the two areas having a close resemblance to one another.

As regards Mount Marmion, we have here a repetition of what takes place in the Fitzroy River district, the appearance of a marine fauna, in beds forming a portion of Hardman's Upper or Sandstone Series.

The conclusions which may be drawn from a study of these fossils from near Derby are briefly the following:—

(1) The Pindan beds may still, for all that is known to the contrary, be regarded as of Tertiary age.

(2) The Ironstone-ridge at Yeeda station cannot be regarded as of the age of the Pindan Series, but is of a similar Carboniferous facies to Mount Marmion, &c.

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* 1st Report, 1884, No. 31, p. 8.

† 2nd Report, 1885, No. 34, p. 16.

‡ Quart. Journ. Geol. Soc., 1883, XXXIX. p. 582.

(3) The Upper or Sandstone Series of Hardman in the Lennard and Fitzroy districts is probably characterised by a fauna as well as a flora.

(4) The fauna in question shows a more general similarity to that of the Permo-Carboniferous formation of Eastern Australia and Tasmania, than it does to any other fossiliferous group of rocks.

EXPLANATION OF PLATE XVII.

Athyris Macleayana, sp.nov.

Fig. 1. View of the flattened ventral valve showing foramen.

Fig. 2. View of convex dorsal view.

Fig. 3. Side view showing line of union of the valves, relative convexity, &c.

Fig. 4. The hinge with united valves, foramen, &c.

Fig. 5. A dorsal valve, decorticated, with the shelly spires visible on the right hand side.

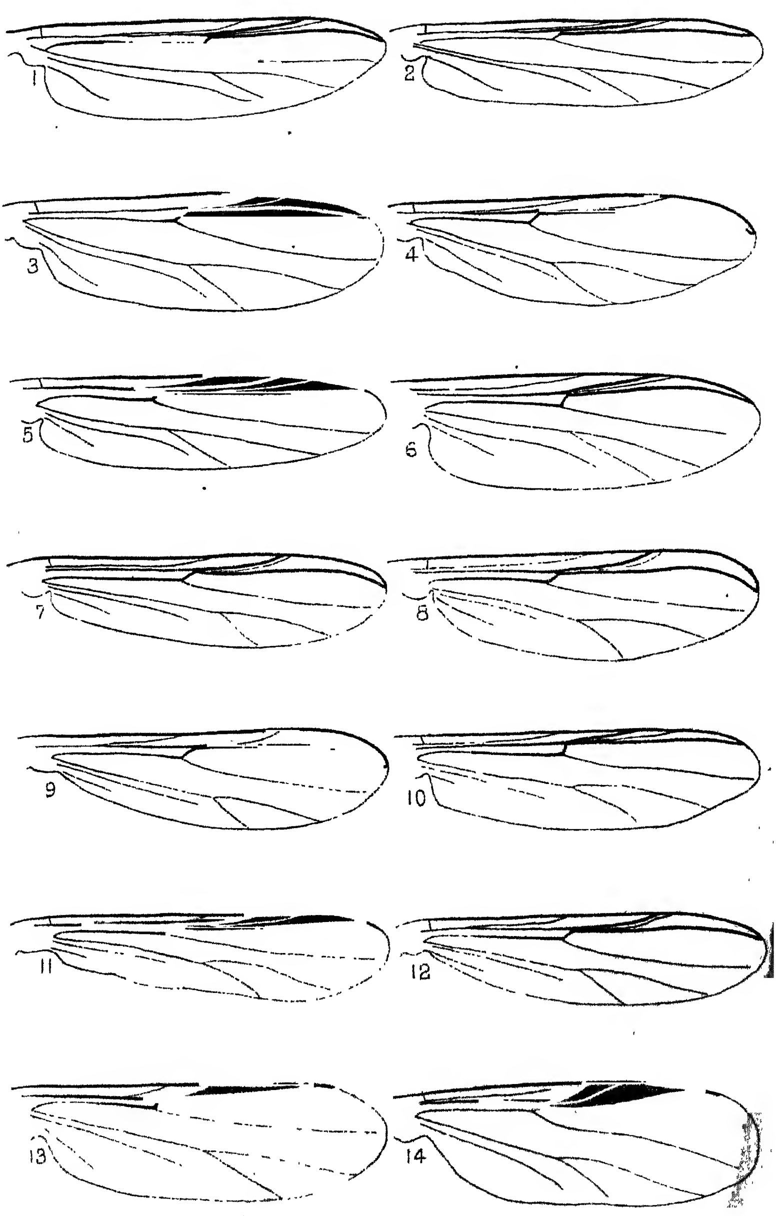
Cyrtina carbonaria, McCoy, var. *australasica*, var.nov.

Fig. 6. View of a ventral valve of a large specimen, defective about the umbonal region.

Fig. 7. Side view of another example, showing relative convexity of the ventral valve.

Fig. 8. Fractured ventral valve with the large septum.

(The figures are all of the natural size.)



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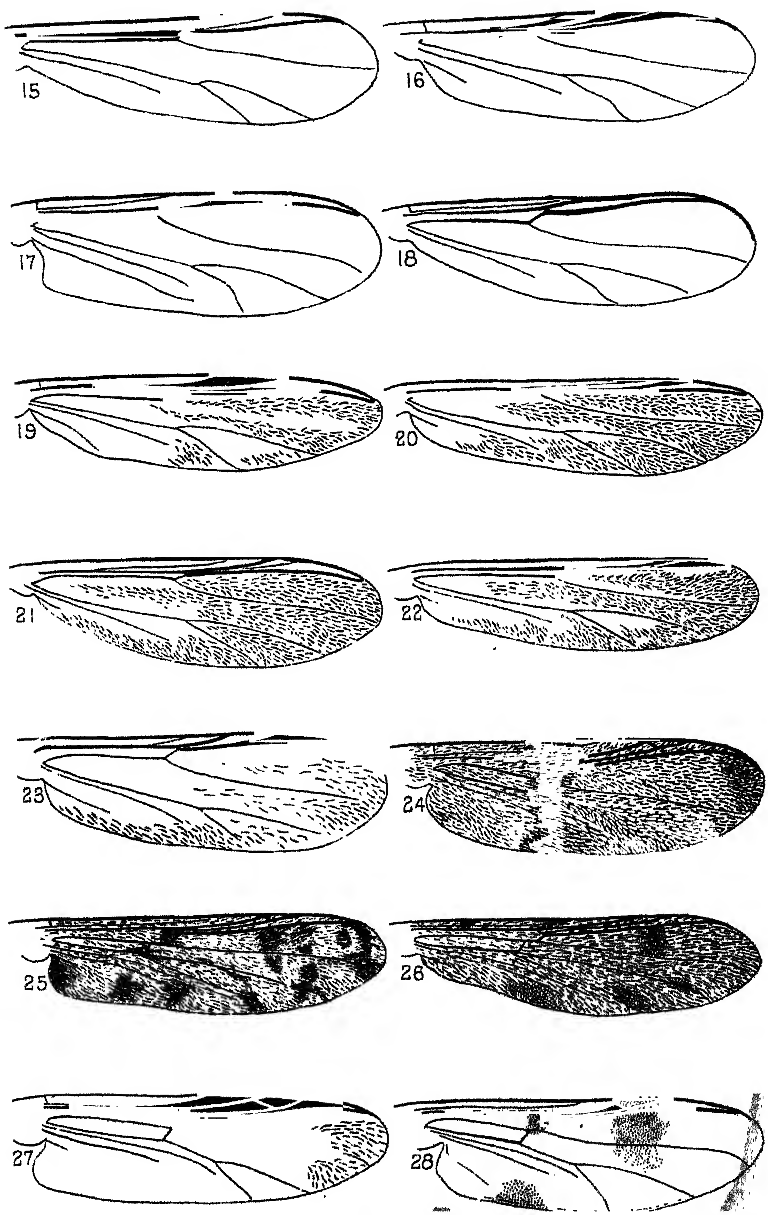
Baron & Gelward lith.



F. A. A. Skuse del

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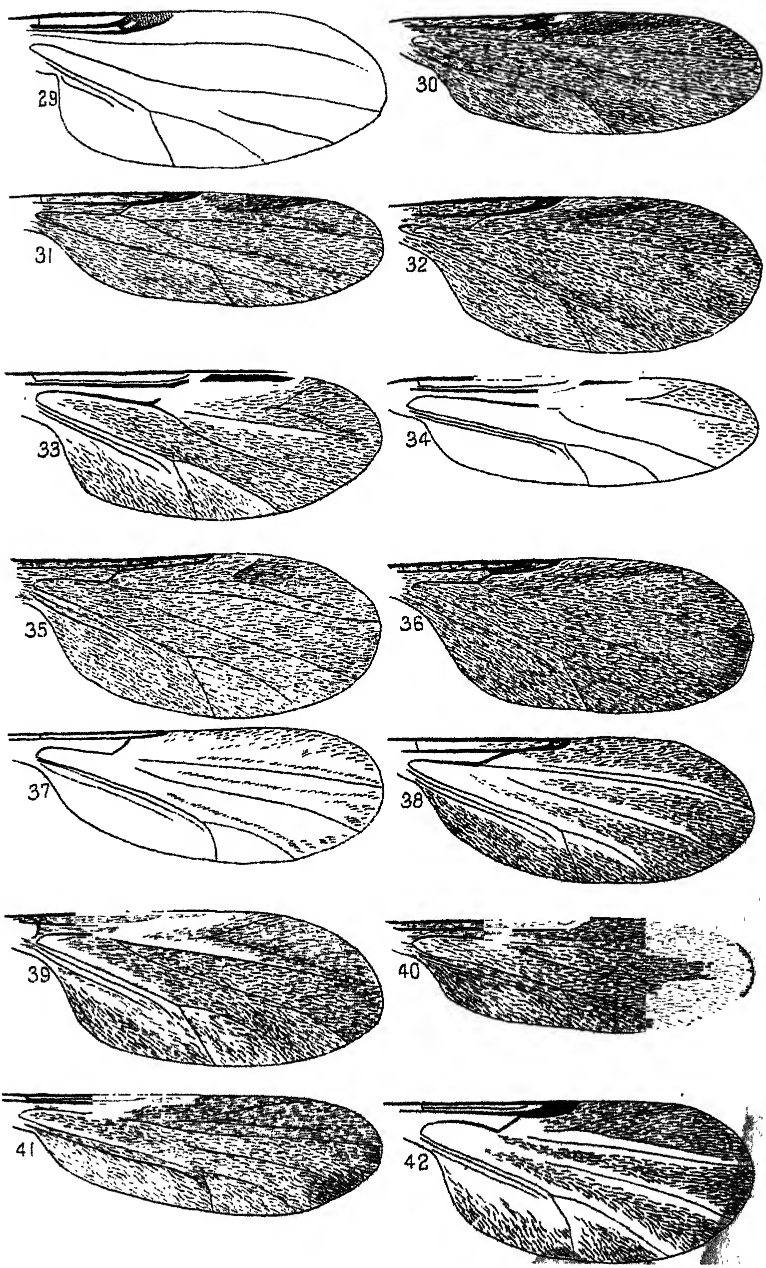
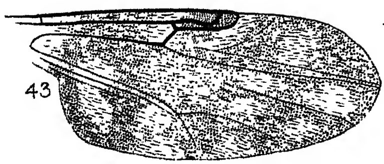


F. A. A. Skuse, del. Baron & Gatward lith.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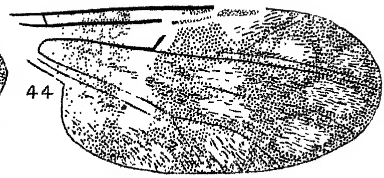
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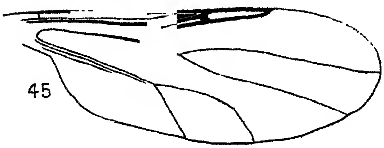
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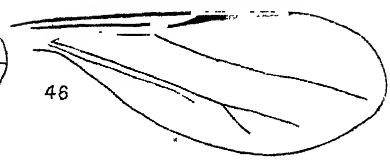
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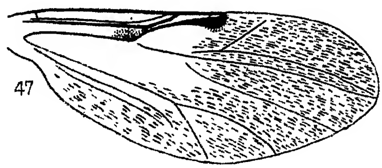
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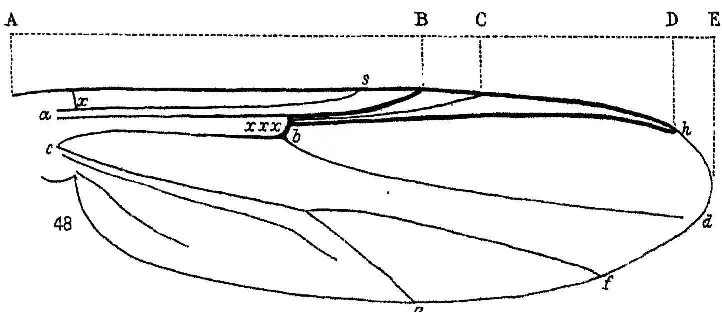

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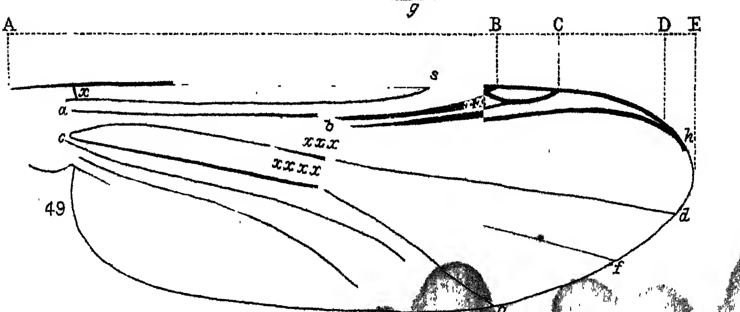

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F. A. A. Skuse del. Baron & Gatward lith.

DIPTERA OF AUSTRALIA.

By Frederick A. A. Skuse.

Part VI.—THE CHIRONOMIDÆ.

(Plates xi.-xiv. and xiv. *bis*).

The descriptions of eight species of Australian Chironomidæ have hitherto been published, while four species of *Chironomus* mentioned by Walker in his "Notes" appear only to have received names. The described species include seven species of *Chironomus*, six by Walker and one by Macquart; and *Ceratopogon rhynchops*, Schiner; all but the latter are described so inadequately as to be quite unintelligible. To these I now add descriptions of sixty-four new species, distributed as follows:—*Chironomus* 21, *Orthocladius* 5, *Camptocladius* 5, *Doloplastus* (gen.nov. allied to *Chironomus*) 1, *Tanytarsus* 7, *Metriocnemus* 1, *Tanypus* 1, *Isoplastus* (gen.nov. allied to *Tanypus*) 3, *Procladius* (gen.nov. allied to *Tanypus*) 2, *Leptoconops* (gen.nov. allied to *Ceratopogon*) 1, and *Ceratopogon* 17, bringing the total up to seventy-two.

The Chironomidæ, or Midges, constitute one of the most richly represented families of the Nematocera, both in regard to species and individuals. It is principally based on the three original genera—*Chironomus*, *Tanypus*, and *Ceratopogon*, characterised by Meigen in 1803, but has subsequently been subdivided into numerous genera. Our knowledge of the family is at present in a very unsatisfactory state, owing principally to the fact that among those who have contributed towards the literature of the group, only a very small number have bestowed upon their work the unstinted labour and precision requisite in treating with such extremely approximate forms. We find that the characters regarded by one author as most important to notice are held in

little or no estimation by others. Those under the latter category are mostly transient describers, who, in the majority of cases, make the species they describe perfectly undeterminable through their insufficient acquaintance with the peculiarities of even the genus to which they *possibly* correctly refer them, and their ignorance of the systems previously elaborated by authors who have perhaps, like Winnertz, devoted years of most careful study in ascertaining the importance and unimportance of the structural characters presented by the species. Consequently just those peculiarities necessary to be pointed out for the correct identification of a certain insect are often quite omitted, and what is sometimes called the description of a species will apply equally well to all the species in the genus, or even to those of allied genera.

Schiner in 1868 (Novara Exp. Dipt. p. 24) recognised sixteen established genera as belonging to this family, not counting his own genus, *Telmatogeton*, created in 1866. The known species of the world were set down as numbering 669, of which 551 occur in Europe, 93 in America, 5 in Africa, 13 in Asia, and 7 in Australia (to which latter *Ceratopogon rhynchops*, Sch., must be added). As far as I can ascertain, a very inconsiderable number of species have been described during the last twenty years, and these principally belong to the genus *Chironomus*. About half the known species are referred to the genus *Chironomus* (though many of them should be removed to the genera subsequently derived from it), and are of unlimited distribution; but as far as has been ascertained, it principally predominates in northern and temperate latitudes. The species of *Chironomus* and closely allied genera now described from Australia constitute the majority of the members of this group as far as its representatives are known, but it is premature to generalise upon the distribution of these or any of the other genera until a great deal more collecting has been done, not only in the other colonies, but also in the vicinity of Sydney. Judging by the result of limited research the number of unknown species,

and perhaps genera, might be very considerable. It is to be regretted that many of the entomologists of this and the other colonies do not more endeavour to extend the knowledge of our least known orders by submitting specimens to those who are striving to work up particular groups.

Tanypus and *Ceratopogon* appear to have a distribution equally as wide as that of *Chironomus*, and include by far the greater number of the remaining species. Doubtless many species of these small flies have been overlooked even in the most thoroughly worked countries.

No New Zealand species of Chironomidæ appear to have been described.

The Midges, like the Culicidæ, may be often seen hovering in the air in great swarms, especially towards evening. As the larvæ and pupæ mostly dwell in water, it is in such localities that the perfect insects are most numerous. Many species may be obtained by the sweeping-net among grass, etc., and others are commonly met with in caves and similarly shady retreats. As far as my observations go, most of these insects are not lovers of sunshine; the species of *Ceratopogon*, however, are often found in sunny situations. Stagnant waters generally teem with the larvæ of *Chironomidæ*. Some of the larvæ are commonly known as blood-worms on account of their colour. The larvæ of *Chironomus stercorarius*, Meig., reside in dung. Both larvæ and pupæ of different species often exhibit marked variations of structure. The habits of *Tanypus* and closely allied genera mostly resemble those of *Chironomus;* the larvæ are often found in swampy places and about the stems of aquatic plants. The larvæ of *Chironomus oceanicus*, Pack., has been obtained from the depth of twenty fathoms in Eastport Harbour, Maine, and in Salem Harbour; and the pupæ and larvæ of a *Tanypus* or allied genus were found in great numbers by Packard in a salt-water lake in California. The genera *Halirytus*, Eaton, and *Psamathiomya*, Deby, have been proposed for the reception of marine Chironomidæ with rudimentary wings. The first was discovered at Royal Sound and

Swaint's Bay, Kerguelen Island, the second in abundance at Biarritz, in the south of France, in both cases by their describers. A species of *Chiromomus* which emits a strong phosphorescent light is reported from a locality near Lake Aral. The females of several species of *Ceratopogon* are bloodsuckers, and capable of inflicting very painful wounds; these annoying insects are particularly numerous in Australia and generally go by the name of "Sand-flies." Their "bites" are quite as severe as those of the mosquitoes, and I am told that in some parts of this country the cattle are dreadfully attacked by them and are sometimes almost driven frantic by the irritation of their wounds. It is possible, however, that the insects referred to really belong to *Simulium*. The larvæ of *Ceratopogon* reside in water, in the ground, in manure, under the bark of decaying timber, etc. Some are said to be carnivorous, devouring the larvæ and pupæ of other insects.

CLASSIFICATION.

Meigen (Syst. Beschr. I. 1818, p. XXXIV.) and Macquart (S. à B. Dipt. I. 1834, p. 41) included in the then known genera of the present family the tribe Tipulariæ culiciformes; Macquart's diagnosis of the group and classification of the genera stands as follows:—

1st Tribe Tipulaires culiciformes, *T. culiciformes*, Meig.

Chars.—Antennæ filiform, in ♂ generally plumose, in ♀ pilose, each inserted in a disciform elevation. Eyes lunate, separated in both sexes. No ocelli. Thorax generally with three elevations; metathorax large. Abdomen of eight distinct segments. Wings recumbent; discoidal cell wanting; interior basilar often confounded with the second posterior; generally one marginal, one sub-marginal, and three posteriors.

A. Antennæ plumose to the extremity.

B. Legs inserted at equal distances; pectus little prominent.

Genus 1. Corethra.

BB. Anterior legs inserted a distance from the others; pectus very prominent.

C. Terminal joint of the antennæ very long in ♂.

Genus 2. Chironomus.

CC. Penultimate joint of the antennæ very long in ♂.

Genus 3. Tanypus.

AA. Antennæ plumose at their base only, or bare.

D. Antennæ plumose in ♂.

Genus 4. Ceratopogon.

DD. Antennæ without plumes. Posterior legs very long.

Genus 5. Macropeza.

The genus *Corethra* should properly have been placed among the Culicidæ, a position it now occupies; the others are typical genera of the Chironomidæ. Since Macquart's work numerous genera have been established, and many have been erected upon such slender grounds as to be quite worthless. *Forcipomyia*, *Palpomyia*, and *Serromyia*, Megerle (in litt.), *Prionomyia*, *Sphæromias*, and *Labidomyia*. Stephens, *Culicoides*, Latr., and *Heteromyia*, Say., might be considered sub-genera of *Ceratopogon*, but I agree with Loew that this division has not been executed in a sufficiently satisfactory manner. By it, some very subordinate characters would be raised to sub-generic rank. Rondani's genera *Apogon*, *Serromyia*, and *Alasion* are insufficiently characterised. Philippi's genera *Podonomus*, *Psychophæna*, *Spaniotoma*, *Pentaneura*, *Tetraphora*, and *Heptagyia*, of which he referred only the first-named to its correct family, are poorly described, and another examination of the types may prove some of them unwarrantable

innovations. Van der Wulp in 1873 split up the genus *Chironomus* into six genera, the leading characters of which are shown in the covering and venation of the wings, and joints of the legs; all these divisions are very useful and appear quite tenable. Besides the above-mentioned there are several other genera by various authors, some of which are unknown to me; their names, however, appear in my list of genera.

Westwood in his generic synopsis (Class. Ins. II. 1840), arranges the genera after much the same manner as Macquart, but adds more particulars about the joints of the antennæ, and introduces the sub-divisions of *Ceratopogon* proposed by Megerle, Latreille, and Stephens as genera.

Family 2. TIPULIDÆ, Leach. (Tipulides, Macq. H.N. Dipt.)

Sub-family 1 Chironomides, Westw. (Culiciformes, Latr., Macq.)

Corethra, Meig. *Chironomus*, p. Fab., 3 sp. *Ch. plumicornis*, Fab.

Antennæ ♂ plumose to the tip; legs placed at equal distances apart; sternum not prominent. Steph. pl. 42, fig. 1.

Chironomus, Meig. *Tipula*, p. Linn., 91 sp. *C. plumosus*, L. Curtis, 90.

Four hind-legs at a distance from the others; sternum prominent; last joint of ♂ antennæ longest (fig. 124 8).

Tanypus, Meig. *Chironomus*, p. Fab., 26 sp. *T. monilis*, L. Curtis, 501.

Antennæ 14-jointed in both sexes, penultimate joint longest; sternum prominent; four hind-legs wide apart.

Sphæromias, Steph. ———, 6 sp. *Sph. albomarginatus*, Curtis, 285.

Antennæ slender, basal joint globular, eight following joints short, five terminal joints long; eyes emarginate; trophi fully developed.

Ceratopogon, Meig. *Chironomus*, p. Fab., 18 sp. *C. stigma*, Meig.

Antennæ ♂ plumose at the base, five terminal joints elongated, simple in ♀; all the femora simple; second joint of the palpi longest; legs of nearly equal length; two sub-marginal cells. Meig., Zw. i. pl. 2, fig. 18.

Palpomyia, Meig.?, Steph. *Ceratopogon*, B. Meig., 10 sp. *C. spinipes*, Meig.

Differs from *Ceratopogon* in having the fore femora thick and spinose beneath. Pz. 103.14.

Prionomyia, St. *Serromyia*, Meig.?, *Ceratopogon*, C. Meig., 6 sp. *Ceratopogon femoratus*, F. Meig., Kl. pl. 2, fig. 4.

Differs from *Ceratopogon* in having the hind femora thickened.

Culicoides, Latr. *Ceratopogon*, p. Meig., 6 sp. *C. pulicaris*, Linn.

Femora simple, not spined; one large imperfect sub-marginal cell. Meig., Zw. i. pl. 2, fig. 17.

Labidomyia, St. *Forcipomyia*, Meig.?, 2 sp. *Cer. bipunctatus*, Linn., Meig.

Orphnephila, Hal. *Chenesia*, Macq., 1 sp. *O. devia*, Hal.

Eyes confluent in front; ocelli wanting; antennæ very short, naked in both sexes; base globose; anterior tarsi elongated; wings incumbent, parallel. Zool. Jour. Vol. v., pl. 15, fig. 2.

The only other distribution of the genera that I have seen is that by Haliday (Ins. Brit. Dipt. III. 1856) in which five only are included; his arrangement is as follows:—

a. Proboscis distinct, with (4-) jointed palpi. Metathorax produced over the base of the abdomen.

b. Mesosternum compressed, gibbous, descending as low as the ends of the posterior coxæ.

c. Wings oblong, with anal angle more or less abrupt.

d. Antennæ with twelve joints or more in the ♂, seven or eight in the ♀. 1. Chironomus.

dd. Antennæ 15-jointed, plumose in the ♂, with the penultimate joint elongated. Pobrachial areolet closed externally. 2. Tanypus.

cc. Wings nearly spatulate, the anal margin being sloped without an angle. 3. Corynoneura.

bb. Metathorax short, descending. Posterior coxæ extending downwards beyond the convex mesosternum. 4. Ceratopogon.

aa. Proboscis and palpi obsolete. Wings coriaceous. 5. Clunio.

It would facilitate the study of the Chironomidæ if the genera were divided into properly defined sections or sub-families, and it appears to me that at least three very natural sections may be thus defined :—

Section I. CHIRONOMINA.

Third and fourth longitudinal veins never furcate. Marginal cross-vein wanting. No posterior cross-vein. Antennæ of ♀ with few joints.

Section II. TANYPINA.

Third and fourth longitudinal veins never furcate. Marginal cross-vein present. Posterior cross-vein present.

Section III. CERATOPOGONINA.

Third longitudinal vein entirely wanting or rudimentary (a fork only being often indistinctly visible). Fourth longitudinal vein furcate. Marginal cross-vein usually present, often wanting. Posterior cross-vein wanting.

Note.—Some of the genera imperfectly or totally unknown to me may require new sections, but this must be determined by others. A separate section ought probably to receive the genera *Halirytus* and *Psamathiomya*, aberrant *Chironomidæ* in which the palpi are 2-jointed, the antennæ 6-jointed, without plumes, and the wings small, rudimentary, and without veins.

LIST OF GENERA CONTAINED IN CHIRONOMIDÆ.

Chironomus, Meigen, Illiger's Magazine, II. p. 260, 1803 (Chironomina).

Tanypus, Meig., l.c. p. 261 (Tanypina).

Ceratopogon, Meig., l.c. (Ceratopogonina).

Macropeza, Meig., Syst. Beschr. I. p. 87, 1818 (unknown to me).

Heteromyia, Say, N. Am. Entom. II. 1825 (Ceratopogonina).

Hydrobænus, Fries, Kon. Vet. Ac. Handl. p. 176, 1829 (Chironomina ?)

Diamesa, Meig., Syst. Beschr. VII. p. 12, 1838 (Chironomina ?).

Corynoneura, Winnertz, Stett. Ent. Zeit. VII. p. 12, 1846 (Ceratopogonina ?).

Oecacta, Poey, Memorias, &c. I. p. 236, 1853 (Ceratopogonina ?).

Clunio, Haliday, Nat. Hist. Review, VI. p. 62, 1855 (Chironomina ?).

Pachyleptus, Walker, Ins. Saund. Dipt. p. 426, 1856 (Ceratopogonina).

Chasmatonotus, Loew, Berl. Entom. Zeit. VIII. 1-2, p. 50, 1864 (unknown to me).

Podonomus, Philippi, V. z.-b. G. Wien, XV. p. 601, 1865 (Tanypina)

Psychophæna, Phil., l.c. p. 628 (Ceratopogonina).

Spaniotoma, Phil., l.c. (Chironomina).

Pentaneura, Phil., l.c. p. 630 (Tanypina ?).

Tetraphora, Phil., l.c. (Chironomina ?).

Heptagyia, Phil., l.c. p. 635 (Tanypina).

Telmatogeton, Schiner, l.c. XVI. p. 931, 1866 (Chironomina).

Smittia, Holmgren, Sv. Ak. Handl. VIII. No. 5, p. 47, 1869 (Chironomina ?).

Cricotopus, Van der Wulp, Tijdschr. Ent. XVII. p. 132, 1873 (Chironomina).

Orthocladius, V.d. Wulp, l.c. (Chironomina).

Camptocladius, V.d. Wulp, l.c. p. 133 (Chironomina).

Tanytarsus, V.d. Wulp, l.c. p. 134 (Chironomina).

Eurycnemus, V.d. Wulp, l.c. p. 135 (Chironomina).

Metriocnemus, V.d. Wulp, l.c. p. 136 (Chironomina).

Halirytus, Eaton, Ent. Mon. Mag. XII. p. 60, 1875 (Ceratopogonina ?).

Limnophyes, Eaton, l.c. (Chironomina).

Didymophleps, Weyenberg, Stett. Ent. Zeit. XLIV. Nos. 1-3, p. 108, 1883 (Ceratopogonina).

Burmeisteria, Weyen., Tijdschr. Ent. XXIX. p. 130, 1886 (unknown to me).

Psamathiomya, Deby, Jour. R. Mic. Soc. II. p. 181, 1889 (Ceratopogonina ?).

Doloplastus, gen.nov. proposed in the present contribution, p. 260 (Chironomina).

Isoplastus, l.c. p. 279 (Tanypina).

Procladius, l.c. p 283 (Tanypina).

Leptoconops, l.c. p. 288 (Ceratopogonina).

VENATION.

The venation of the wings is considerably modified in the the Chironomidæ. We have clearly three principal types of venation, which at once suggest the division of the genera into sections. The homologies of these types at first seem doubtful and obscure, and, as might be expected, the opinions of authors differ considerably about the terminology of the veins. What one author considers part of one vein, another regards as the whole, or a portion, of another; one vein is sometimes named twice, and two veins united under a single name. Occasionally the rudimentary condition or complete absence of a certain vein will lead to a

misunderstanding of those really represented, the lost vein being considered present. My theory of the venation in this family differs almost entirely from that of Winnertz (as exemplified in his monograph of the genus *Ceratopogon*), but agrees principally with those of Schiner (V.z-b. G. Wien, Bd. XIV. 1864) and Van der Wulp (Tijd. v. Entom. XIV. 1871, p. 79-98). The latter author bases his nomenclature on that of Schiner, and gives (pp. 82-83) an elaborate table of the different terminologies of Meigen (1), Macquart (2), Winnertz (2), and Schiner (2). In the nomenclature employed by me I endeavour to follow Loew and Osten-Sacken (Mon. Dipt. N. Amer.).

On comparing the wings of *Chironomus* and *Tanypus* it is at once evident that Winnertz's Wurzel- or Unterrandader (in *Ceratopogon*) is composed really of the basal portion of the first longitudinal and the whole of the second longitudinal; in the former two genera the second and third longitudinal veins take their origin, the one from the other, at or beyond the middle of the first longitudinal, and the presence of the marginal cross-vein and rudimentary third longitudinal vein found in the wing of so many species of *Ceratopogon* further testifies to the correctness of this veiw. Van der Wulp regards the second longitudinal (his Radiaalader) as wanting in *Ceratopogon;* this vein, however, is plainly present, and is called by him the Cubitaalader, really the correct name of the rudimentary third longitudinal overlooked by him. The second longitudinal and the marginal cross-vein are, however, sometimes so reduced in *Ceratopogon* that they, in a few instances, are known to amalgamate with, and form an incrassation of, the tip of the first longitudinal. In *Chironomus* and *Tanypus* the second longitudinal vein is often pale and sometimes entirely wanting. The posterior branches of the fourth and fifth longitudinal veins are named as distinct veins by Winnertz.

The following table gives the nomenclature of the alar venation in *Ceratopogon* as interpreted by Winnertz and V. d. Wulp, compared with that substituted in the following pages, and will assist in reading the descriptions of these authors :—

WINNERTZ. (Beit. zur Kennt. der Gattung *Ceratopogon*, 1852.)	VAN DER WULP. (Tijd. v. Entom. XIV., pl. 3, *Ceratopogon*, 1871).	TERMINOLOGY ADOPTED IN THE PRESENT ESSAY.
ADERN.	ADEREN.	VEINS.
Randader	Randader	Costa *(v. costalis)*.
Wurzelquerader	Worteldwarsader	Transverse shoulder-vein *(v. trans. humeralis)*.
Afterader (1)	Hulpader	Auxiliary *(v. auxiliaris)*.
....	Subcostaalader	First longitudinal *(v. long. 1ma)*.
Wurzel- oder Unterrand-Ader, der Cubitus ...	....	Portion of the first longitudinal vein before the middle cross-vein + the second longitudinal vein.
Zwischenader	....	Portion of the first longitudinal vein beyond the origin of the second longitudinal.
Randfeldquerader ...	....	Marginal cross-vein.
....	Cubitaalader	Second longitudinal *(v. long. 2da)*.
....	....	Third longitudinal *(v. long. 3a)*.
Rucklaufende Ader ...	Middeldwarsader	Middle cross-vein *(v. trans. media)*.
Mittelader + Scheibenader	Discoidaal- of shijfader	Fourth longitudinal *(v. long. 4a)*.
Achselader + Hinterader	Posticaalader	Fifth longitudinal *(v. long. 5a)*.
Afterader (2)	....	Sixth longitudinal *(v. long. 6a)*.
Afterader (3)	....	Seventh longitudinal *(v. long. 7a)*.
ZELLEN.	CELLEN.	CELLS.
Vordern Randzelle ...	Rand- of Costaalcel ...	Subcostal *(c. subcostalis)*.
Vordern Thiel der hintern Randzelle	Cubitaalcel	Inner marginal (*c. marginalis interior*)
Hintern Theil der hintern Randzelle	Subcostalcel	Marginal *(c. marginalis)*.
Vordern Cubitalzelle ...	Bovenste wortelcel ...	1st Basal *(c. basalis 1ma)*.
Hintern Cubitalzelle ...	Eerste achtercel	1st Posterior *(c. posterior 1ma)*.
Obern Scheibenzelle ...	Tweede achtercel... ...	2nd Posterior *(c. posterior 2da)*.
Untern Scheibenzelle ...	Derde achtercel	3rd Posterior *(c. posterior 3a)*.
Hintern Achselzelle ...	Vierde achtercel	Anal *(c. analis)*.
Vordern Achselzelle ...	....	Spurious.

Section I. Chironomina.

Head small, transverse, situated deep in thorax. Eyes more or less reniform, separate in both sexes (approximate beneath in *Clunio*). Ocelli wanting. Palpi porrected, pubescent, sub-cylindrical, curved, four-jointed; first joint very small, second and third moderately long, of equal length, fourth as long or longer (wanting in *Clunio*). Proboscis short (obsolete in *Clunio*). Antennæ porrect, normally 2- + 12-jointed in ♂, 2- + 5-jointed in ♀, rarely with an equal number of joints in both sexes; first joint of the scapus large, globose or disciform, the second small; in ♂ usually as long as thorax, densely plumose, the verticils diminishing in length towards the extremity; first eleven flagellar joints extremely short, terminal joint filiform, very long; in ♀ usually about half the length of thorax, flagellar joints ovate, oblong, or elongate-pyriform, increasing in length from first, sparingly verticillate-pilose, terminal joint slender, pilose. Thorax ovate or elongate-ovate, gibbose, more or less projecting in front, usually with three dark stripes; scutellum small, semicircular; metathorax prominent. Halteres short. Abdomen eight-segmented; long and slender in ♂, anal joint distinct, forceps prominent, generally falcate or filiform; in ♀ shorter and more robust. Legs more or less long and slender, anterior pair remote from the others; coxæ short; tibiæ more or less confluently-calcarate at apex; as long, longer or shorter than metatarsus; ungues small. Wings narrow, elongate, lanceolate, more or less rectangular at base, naked or pubescent, ciliated; deflexed in repose. Humeral cross-vein present. Sub-costal cross-vein always (?) absent. Marginal cross-vein wanting. Posterior transverse-vein wanting. Auxiliary vein usually pale and indistinct, often scarcely reaching costa about middle of anterior border or beyond it. Costal usually terminating at tip of third longitudinal vein, sometimes extending a little

beyond it. First longitudinal vein reaching costa beyond middle. Second and third longitudinal veins originating together from first longitudinal vein at apex of middle cross-vein, which may be situated before, at or beyond middle of wing; second longitudinal vein usually very pale and indistinct, or wanting (?). Third longitudinal never furcate, bent upwards or downwards towards tip. Fourth longitudinal never furcate, originating at base of fifth longitudinal, usually slightly angulated at middle cross-vein, gently arcuated anteriorly, straight, or somewhat sinuose beyond it, not quite reaching wing-margin, or indistinctly reaching it, at or below the apex.* Fifth longitudinal vein forked before, at or beyond middle of wing, fork acuminate at base; anterior branch straight or slightly arcuated posteriorly, longer than posterior, latter straight, slightly arcuated or sinuose.

Genus 1. Chironomus, Meig.

Chironomus, Meigen, Illiger's Mag. II. p. 260, 1803; Latreille, Gen. Cr. et Ins. IV. p. 248; Macquart, S. à B. I. p. 47, 1834; Zetterstedt, D. Sc. IX. 1850; Walker, I.B. p. 149, 1856; Schiner, F.A. Dipt. 1864; V. d. Wulp, Tijd. Entom. XVII. p. 129, 1873-74.

Antennæ 2-+12-jointed in ♂, 2-+5-jointed in ♀. Thorax usually with three stripes. Wings naked. Costal vein not extending beyond tip of third longitudinal vein. In fore legs metatarsus longer than tibia, or (by exception) at least as long as it. Anal joint of ♂ abdomen longer than broad; forceps generally filiform or falcate.

* In most cases it is impossible, without the aid of the microscope, to discover that the fourth longitudinal vein does not really reach the wing-margin; the ordinary entomological lens will rarely reveal the fact.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance							
		Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
219	*Ch. occidentalis* ..	...	...	...	...	...	...	...	...	79	7	13	1
220	*Ch. Nepeanensis*...	64	36	...	...	81	4	13	2	...	...	...	...
221	*Ch. egregius*... ...	63	37	...	...	77	6	16	1	...	...	...	...
222	*Ch. pervagatus* ...	...	..	64	36	...	...	...	...	77	6	15	1
223	*Ch. intertinctus* ...	64	36	65	35	80	4	14	2	76	5	18	1
224	*Ch. subdolus* ...	64	36	...	...	79	5	15	1	...	...	...	...
225	*Ch. Hexhamensis*	64	36	...	...	78	6	14	2	...	...	...	...
226	*Ch. blandus*... ...	...	...	65	35	...	...	...	...	75	5	19	1
227	*Ch. januarius* ...	65	35	...	...	78	4	16	2	...	...	...	...
228	*Ch. delinificus* ...	63	37	...	...	74	5	19	2	...	...	...	...
229	*Ch. pulcher*	...	...	60	40	...	...	...	...	65	8	22	5
230	*Ch. seorsus*	...	...	65	85	..	...	...	...	74	3	23	0
231	*Ch. orarius*	65	35	?	?	73	3	23	1	78	4	17	1
232	*Ch. erebeus*	...	...	63	37	...	...	...	...	73	10	12	5
233	*Ch. Tepperi* ...	...	...	65	35	...	...	...	...	73	5	20	2
234	*Ch. fluviaticus* ...	65	35	...	...	74	9	15	2	...	...	...	...
235	*Ch. subvittatus* ...	67	33	...	...	73	6	17	4	...	...	...	...
236	*Ch. oresitrophus*...	64	36	67	33	73	2	25	0	72	3	25	0
237	*Ch. vespertinus* ...	63	37	...	...	71	7	21	1	...	...	...	...
238	*Ch. brevis*	...	...	63	37	...	...	...	...	69	3	28	0
239	*Ch. nubifer*	66	34	65	35	78	4	16	2	76	4	17	3

A. Thorax pale with three distinct stripes.

219. CHIRONOMUS OCCIDENTALIS, sp.n. (Pl. XI., fig. 1.).

♀.—Length of antennæ......	0·042 inch	...	1·06 millimètres.
Expanse of wings........	0·240 × 0·065	...	6·09 × 1·66
Size of body...............	0·310 × 0·047	...	7·87 × 1·18

Antennæ wholly ochre-yellow. Head ochreous-brown, with golden-yellow hairs. Clypeus and palpi ochreous-brown, densely covered with golden-yellow pubescence, that on the former longer. Thorax pale pinkish-ochreous with three longitudinal stripes of light fuscous, the lateral ones starting somewhat above middle of thorax, running almost to a point posteriorly and reaching hinder margin, intermediate one beginning at collare, terminating somewhat beyond the middle, with a light brown median line supporting a double row of short golden-yellow hairs; a row of longer hairs between the stripes; pleuræ pale pinkish-ochreous; scutellum yellowish, light fuscous along base, fringed with long golden-yellow hairs; metanotum pinkish-ochreous. Halteres pale yellow. Abdomen thrice length of thorax, umbrous-brown, each segment bordered posteriorly with very pale ochreous or whitish, the bands narrower on each succeeding segment, lamellæ of ovipositor ochre-yellow. Legs yellow; tarsi brownish-yellow, each joint slightly tipped with light fuscous (tarsal joints of fore legs and those with tibiæ of hind legs lost). In intermediate legs tibiæ exactly the length of femora and twice the length of metatarsus; metatarsus not quite twice the length of second tarsal joint, this joint $\frac{1}{3}$ longer than fourth and twice the length of fifth. Wings hyaline, glabrous, costal and first two longitudinal veins brownish-yellow, marginal cross-vein and portion of the second longitudinal vein between that and origin of third longitudinal vein suffused with brown. Costal and third longitudinal meeting nearly at apex of wing; auxiliary vein joining costa opposite middle of posterior branch of fifth longitudinal vein; second longitudinal

vein somewhat indistinct, reaching costa nearly opposite tip of anterior branch of fifth longitudinal fork; fourth longitudinal almost reaching the wing-margin, its tip situated at a point $\frac{1}{3}$ the distance from tip of costa to that of anterior branch of fifth longitudinal fork; posterior branch of latter $\frac{3}{5}$ length of anterior.

Hab.—King George's Sound, West Australia (Masters). One specimen.

220. CHIRONOMUS NEPEANENSIS, sp.n.

♂.—Length of antennæ	0·075 inch	...	1·89 millimètres.
Expanse of wings........	0·180 × 0·037	...	4·56 × 0·92
Size of body	0·300 × 0·037	...	7·62 × 0·92

Antennæ dark brown, with light bronzy-brown plumes; first joint of scapus dark brown, somewhat pruinose. Head, clypeus, and palpi brown, with brown hairs. Thorax pale greenish-yellow with three bands; anterior band fulvous, bordered laterally, except for its anterior third, with a dark brown line, base united to scutellum by a fine brown line, lateral bands fulvous posteriorly, dark brown anteriorly, united at apex to anterior extremity of dark brown border of middle band by dark brown line; bands and lines with a hoary appearance when viewed in a certain light; a median longitudinal row of short pale yellow hairs in the anterior band, and another of longer hairs along inside margin of lateral bands; pleuræ and scutellum pale greenish-yellow, the latter fringed with yellow hairs; pectus brownish, hoary; metanotum deep brown, almost black, dark fulvous at each side. Halteres pale yellow. Abdomen about three times length of thorax, greenish-yellow, tinged with brownish, second to fourth segments bordered anteriorly with a moderately broad ring of deep brown, with the last two segments entirely deep brown; all segments with a light reflection on posterior margin; densely clothed with long pale yellow hairs; anal joint and forceps dark brown, densely haired. Legs yellowish or pale ochreous, the femora, tibiæ, and all tarsal joints slightly tipped with brown,

tibiæ of the fore legs also brown at base. In fore legs metatarsus $\frac{1}{3}$ longer than tibia. Wings considerably shorter than abdomen, hyaline, veins very pale, ochreous-yellow, marginal cross-vein and portions of the neighbouring veins suffused with deep brown or black; veins pale. Costal and third longitudinal meeting a little before apex of wing; auxiliary vein reaching costa opposite tip of posterior branch of fifth longitudinal fork; second longitudinal distinct for the whole of its length, reaching costa a little past tip of first longitudinal; fourth longitudinal very pale past the middle cross-vein, almost reaching the wing-margin, its tip about midway between tip of costa and that of anterior branch of fifth longitudinal fork; base of the latter situated opposite base of middle cross-vein, its posterior branch rather more than half the length of anterior.

Hab.—Nepean River, near Penrith, N.S.W. (Skuse). September.

Obs.—I have taken but one specimen of this conspicuous insect.

221. CHIRONOMUS EGREGIUS, sp.n.

♂.—Length of antennæ......	0.070 inch	...	1·77 millimètres.
Expanse of wings........	0·160 × 0·040	...	4·06 × 1·01
Size of body..............	0·270 × 0·037	...	6·85 × 0·92

Antennæ light ochreous-brown; first joint of scapus light ferruginous. Head, clypeus, and palpi ochreous-brown. Thorax pale greenish-yellow, with three broad fulvous bands, middle one united to the scutellum by a fine line; pleuræ pale greenish or greenish-yellow, sometimes, with pectus, pale fulvous; scutellum pale greenish-yellow, fringed with yellow hairs; metanotum light umbrous-brown, yellow anteriorly, with a very fine median yellow line. Halteres pale yellow. Abdomen nearly three times length of thorax, prasinous, the last three segments pale brown, each segment marked longitudinally with deep brown, the markings on second, third, and fourth segments olive brown, more or less

diamond-shaped, densely clothed with rather long pale yellow hairs; anal joint and forceps dark brown, more or less tinged with ochreous. Legs very pale ochreous-yellow, last two tarsal joints and extreme tips of preceding ones more or less dusky, densely clothed with pale yellow hairs; tibial spurs deep brown. In fore-legs metatarsus nearly twice the length of tibiæ. Wings shorter than abdomen, hyaline, iridescent, costal, first and third longitudinal veins and basal portion of fourth longitudinal vein ochre-yellow, distinct. Costal and third longitudinal veins meeting a little before the apex of the wing; auxiliary vein indistinct, scarcely reaching costa, its tip about opposite that of posterior branch of fifth longitudinal fork; second longitudinal indistinct towards its tip, scarcely reaching costa, terminating a short distance beyond tip of first longitudinal vein; fourth longitudinal vein pale beyond middle cross-vein, not quite reaching wing-margin, its tip situated about $\frac{1}{3}$ the distance from tip of costa to that of anterior branch of fifth longitudinal fork; base of latter lying opposite base of middle cross-vein, its posterior branch rather more than half the length of anterior.

Hab.—Sydney (Masters and Skuse); Hexham near Newcastle, N.S.W. (Skuse); Victoria Park, Brisbane, in November (Mr. H. Tryon). April.

222. Chironomus pervagatus, sp.n.

♀.—Length of antennæ......	0·037 inch	...	0·92 millimètre.
Expanse of wings........	$0{\cdot}185 \times 0{\cdot}057$	...	$4{\cdot}68 \times 1{\cdot}44$
Size of body..............	$0{\cdot}250 \times 0{\cdot}040$	...	$6{\cdot}34 \times 1{\cdot}01$

Antennæ brown, dusky towards the extremity, the basal joint and first two flagellar joints sometimes ochreous-yellow. Head ochre-yellow or brownish-yellow. Face, clypeus, and palpi brown or yellowish-brown. Thorax ochre-yellow, pale yellowish-brown, with three brown stripes, the anterior one with a lighter (sometimes darker) median line which continues to the scutellum; three longitudinal rows of pale yellow hairs; pleuræ ochreous,

ochreous-brown or brown, sometimes with a small perpendicular oblong brown spot under the origin of the wings; pectus light reddish-brown to deep brown; scutellum yellow or sordid yellow, fringed with pale yellow hairs; metanotum usually dark brown, sometimes lighter. Halteres yellow. Abdomen about three times length of thorax, clothed with pale yellow hairs, more or less dark brown, posterior borders of segments sometimes slightly fulvous. Legs yellow or pale ochre-yellow; tarsi more or less brownish or dusky. Tibial spurs deep brown or black. In fore legs metatarsus twice length of tibia. Wings shorter than abdomen, hyaline, weakly iridescent; costal, first and third longitudinal veins, middle cross-vein, and basal half of fourth longitudinal distinct, ochreous-brown. Costal and third longitudinal veins meeting somewhat before apex of wing; auxiliary very pale and indistinct, reaching the costa opposite or somewhat beyond middle of posterior branch of fifth longitudinal fork; second longitudinal vein very pale, especially towards tip, terminating at a point about $\frac{1}{3}$ distance from tip of first longitudinal to that of third longitudinal; fourth longitudinal very pale beyond cross-vein, almost reaching wing-margin, its tip situated at a point not $\frac{1}{3}$ the distance from tip of third longitudinal vein to that of anterior branch of fifth longitudinal fork; base of latter lying a little beyond middle cross-vein, its posterior branch nearly $\frac{2}{3}$ the length of anterior.

Hab.—Lawson, Berowra, and Sydney, N.S.W. (Masters and Skuse).

223. Chironomus intertinctus, sp.n.

♂.—Length of antennæ......	0·075 inch	...	1·89 millimètres.
Expanse of wings........	0·150 × 0·032	...	3·81 × 0·80
Size of body..............	0·240 × 0·037	...	6·09 × 0·92
♀.—Length of antennæ......	0·032 inch	...	0·80 millimètres.
Expanse of wings........	0·150 × 0·037	...	3·81 × 0·92
Size of body..............	0·200 × 0·037	...	5·08 × 0·92

♂ and ♀.—Antennæ light brown in ♂, fuscous in ♀; joints of the scapus varying from ochreous-yellow to light fuscous brown. Head, clypeus, and palpi light fuscous-brown, clypeus sometimes yellowish; head with yellow, and clypeus and palpi with brownish hairs. Thorax pale greenish-yellow (slightly tinged with brown in some specimens) with three longitudinal stripes, fulvous in ♂, very prominent and deep castaneous-brown in ♀; intermediate stripe with a sparse median line of short yellow hairs, also a row between the stripes extending the whole length of the thorax; pectus more or less tinged with brown; pleuræ pale greenish-yellow, more or less distinctly tinged with pale fulvous; scutellum pale greenish or greenish-yellow, sometimes with a fulvous tint, fringed with yellow hairs; metanotum in ♂ pale fulvous-yellow, in ♀ the anterior half pale greenish, greenish or fulvous-yellow, posterior half deep castaneous-brown with a pale median line. Halteres pale yellowish-green in ♂, almost æruginous in ♀. Abdomen about three times the length of the thorax in ♂, shorter in ♀, prasinous, clothed with pale yellow hairs, the last two abdominal segments of ♂ tinged with brown, and anal joint and holding forceps entirely brown; lamellæ of ♀ ovipositor light brown. Coxæ and femora pale greenish-yellow; in fore legs apex of the femora and entire tibiæ and tarsi deep fuscous-brown, in intermediate and hind legs extreme tip of femora generally very slightly brownish. Tibiæ in intermediate and hind legs pale brownish-yellow, deep fuscous at extreme base and extreme apex. Tarsi fuscous-brown, basal three-fourths or more of metatarsi brownish-yellow. In fore legs tibiæ a little more than half the length of metatarsus. Wings shorter than the abdomen in ♂, as long or longer than it in ♀; hyaline, iridescent, the costal, first three longitudinal veins, and basal half of fourth longitudinal brownish-ochreous. Costal and third longitudinal veins meeting a short distance from apex of wing; auxiliary vein joining costa not quite mid-way between middle cross-vein and tip of the first longitudinal; first longitudinal joining costa before tip of anterior branch of fifth longitudinal fork; fourth longitudinal vein almost reaching wing-margin, its tip situated nearer tip of costa than to

that of anterior branch of fifth longitudinal fork; base of the latter situated somewhat beyond middle cross-vein; its posterior branch ½ the length of anterior.

Hab.—Wheeny Creek, Hawkesbury District, and Hexham Swamps, near Newcastle, N.S.W. (Skuse); Brisbane, Queensland (taken at light by Mr. H. Tryon). November to April.

224. Chironomus subdolus, sp.n.

♂.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·130 × 0·030	...	3·30 × 0·76
Size of body..............	0·200 × 0·027	...	5·08 × 0·68

Antennæ brown, with somewhat bronzy-brown plumes; first joint of scapus umber-brown. Head pale greenish-yellow with pale yellow hairs. Clypeus and palpi light greenish-brown. Thorax, pleuræ, and scutellum pale greenish or greenish-yellow, the former with three ochraceous-ferruginous bands; pale yellow hairs; pectus brownish; metanotum deep brown, pale greenish-yellow anteriorly, and with a very fine pale median line. Halteres very pale green. Abdomen nearly three times length of thorax, prasinous, second to fifth segments with a diamond-shaped olive-brown spot superiorly, last two segments entirely blackish-brown; rather moderately clothed with short pale yellow hairs; anal joint and forceps dusky brown, with short hairs. Coxæ and femora pale greenish-yellow. Tibiæ and tarsi of a more ochreous-yellow, joints of tarsi almost imperceptibly tipped with brown. Tibial spurs deep brown or black. In fore legs metatarsus twice length of tibia. Wings shorter than abdomen, hyaline: costal, first three longitudinal veins and basal half of fourth longitudinal vein brownish-ochreous. Costal and third longitudinal veins meeting a little before apex of wing; auxiliary vein indistinctly reaching costa opposite middle of posterior branch of fifth longitudinal fork; second longitudinal joining costa a short distance beyond tip of first longitudinal; fourth longitudinal pale beyond

middle cross-vein, not reaching wing-margin, its tip situated at a point $\frac{1}{5}$ the distance from tip of costa to that of anterior branch of fifth longitudinal fork; latter very pale, its base lying opposite middle cross-vein, posterior branch $\frac{1}{2}$ the length of anterior.

Hab.—Clifton, Illawarra district, N.S.W. (Skuse). December.

225. CHIRONOMUS HEXHAMENSIS, sp.n.

♂.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·120 × 0·030	...	3·04 × 0·76
Size of body..............	0·200 × 0·023	...	5·08 × 0·58

Antennæ light ochreous-brown; first joint of scapus fulvous. Head, clypeus, and palpi ochreous-brown. Thorax, pleuræ, scutellum, and abdomen prasinous; three bands of thorax, pectus, and metanotum fulvous. Halteres pale yellow. Abdomen three times the length of thorax, rather densely clothed with yellow hairs; anal joint and forceps light ochreous-brown, densely haired. Coxæ and femora prasinous. Tibiæ greenish-yellow, apical spurs black or deep brown. Tarsi dusky, except metatarsi of intermediate and hind legs, which are more or less yellowish or fulvous. In fore legs tibiæ not quite $\frac{2}{3}$ the length of metatarsus. Wings shorter than abdomen, hyaline, with a weak reflection, all the veins tolerably distinct, brownish. Costal and third longitudinal veins meeting somewhat before apex of wings; auxiliary vein reaching costa opposite tip of posterior branch of fifth longitudinal fork; second longitudinal vein running close to first longitudinal, pale, terminating in the costa a short distance past tip of latter; fourth longitudinal pale past middle cross-vein, indistinctly reaching the margin, its tip somewhat nearer to tip of costa than to that of anterior branch of fifth longitudinal fork; base of the latter almost opposite, but somewhat beyond, middle cross-vein, its posterior branch about half the length of the anterior.

Hab.—Hexham, near Newcastle, N.S.W. (Skuse); Adelaide, S. Australia (*Coll. Adelaide Museum*, Mr. T. P. O. Tepper). December to April.

226. Chironomus blandus, sp.n.

♀.—Length of antennæ......	0·025 inch	...	0·62 millimètre.
Expanse of wings........	$0·135 \times 0·037$	...	$3·42 \times 0·92$
Size of body..............	$0·150 \times 0·027$	...	$3·81 \times 0·68$

Antennæ light brown, tinged with ochreous. Head, clypeus, and palpi light brown; pale pubescence. Thorax pale greenish-yellow, with three pale fulvous stripes more or less tinged with greenish; longitudinal row of pale hairs between the bands from anterior extremity of lateral ones to scutellum; pleuræ, pectus, scutellum and metanotum pale greenish-yellow; scutellum fringed with long pale yellow hairs. Halteres pale greenish-yellow. Abdomen twice the length of thorax, pale prasinous, the last two segments brownish, (the last five segments brownish beneath, but this may be merely discoloration) clothed with tolerably long pale yellow hairs. Legs pale greenish-yellow, fore tibiæ and tarsi, and last four tarsal joints in intermediate and fore legs more or less brownish. Tibial spurs deep brown. In fore legs metatarsus about twice the length of tibia. Wings longer than abdomen, pellucid, somewhat opaline, costal, first and third longitudinal, middle cross-vein, and basal half of the fourth longitudinal veins distinct, greenish-yellow. Costal and third longitudinal veins meeting a little before apex of wing; auxiliary vein indistinctly reaching costa about opposite middle of posterior branch of fifth longitudinal fork; second longitudinal pale, running close to first longitudinal and for a little distance along costa; fourth longitudinal vein pale beyond middle cross-vein, not quite reaching wing-margin, its tip situated at a point about half way between tips of costal and anterior branch of fifth longitudinal fork; base of the latter lying somewhat beyond middle cross-vein, its posterior branch ½ the length of anterior.

Hab. Narrabeen Lagoon, near Manly, N. S. Wales (Skuse). January.

227. CHIRONOMUS JANUARIUS, sp.n.

♂.—Length of antennæ......	0·040 inch	...	1·01 millimètres.
Expanse of wings........	0·110 × 0·027	...	2·79 × 0·68
Size of body.............	0·140 × 0·020	...	3·55 × 0·50

Antennæ pale brown; first joint of scapus reddish-brown. Head brown. Clypeus and palpi light reddish-brown. Thorax greenish-yellow or pale ochreous, with three somewhat indistinct light brown bands, the anterior one united to the scutellum by a light brown line; a longitudinal row of yellow hairs between the bands and on anterior portion of the intermediate one; pleuræ and pectus pale ochreous-brown; scutellum sordid ochreous-yellow, fringed with long yellow hairs; metanotum purplish-brown. Halteres pale green. Abdomen rather more than thrice the length of thorax, umbrous-brown, sub-levigate, rather densely clothed with moderately long yellow hairs. Legs yellow, the tibia terminating in deep brown or black spines, the tarsi except metatarsal joint of fore legs light brown, dark brown at the extreme apices of the joints. In fore legs metatarsus twice the length of tibia. Wings rather shorter than abdomen, hyaline; costal, first and third longitudinal, and basal half of the fourth longitudinal vein, brownish-yellow. Costal and third longitudinal vein meeting a short distance before apex of wing; auxiliary vein joining costa before middle of posterior branch of fifth longitudinal fork; second longitudinal vein joining costa a little beyond tip of first longitudinal vein; fourth longitudinal vein pale almost reaching the wing-margin, its tip situated nearer to tip of costa than to that of anterior branch of fifth longitudinal fork; base of latter lying opposite middle cross-vein, its posterior branch a little more than half the length of anterior.

Hab.—Wheeney Creek, N.S.W. (Skuse). January.

228. CHIRONOMUS DELINIFICUS, sp.n. (Pl. XI., fig. 2).

♂.—Length of antennæ.......	0·037 inch	...	0·92 millimètre.
Expanse of wings.........	0·085 × 0·020	...	2·14 × 0·50
Size of body...............	0·120 × 0·017	...	3·04 × 0·42

Antennæ light ochreous-yellow; joints of scapus reddish-brown. Head, face, clypeus and palpi brown, with a yellow pubescence. Thorax ochre-yellow, with no anterior stripe, two lateral stripes of brown posteriorly, and an intermediate narrow stripe of same colour not reaching scutellum; pleuræ ochre-yellow; pectus tinged with brown; scutellum pale yellow; metanotum ochreous-brown with a darker median line. Halteres pale yellow. Abdomen nearly three times the length of thorax, pale yellowish-green, with a rather dense covering of pale yellow hairs; anal joint and forceps narrow, yellowish-green. Legs light ochre-yellow (tarsal joints of the fore legs lost); tibial spurs black. Wings nearly the length of abdomen, pellucid, almost hyaline; costal, first and third longitudinal, middle cross-vein, and basal half of fourth longitudinal veins yellow, distinct. Costal and third longitudinal veins meeting a short distance before apex of wing; auxiliary vein pale, indistinct towards tip, apparently terminating in costa at a point about $\frac{2}{3}$ the distance from middle cross-vein to tip of first longitudinal vein; second longitudinal vein very pale, running close to third longitudinal for greater part of its length, joining costa a short distance beyond tip of first longitudinal; fourth longitudinal pale beyond the middle cross-vein, very nearly reaching wing-margin, its tip situated at a point nearer to tip of costal than to that of anterior branch of fifth longitudinal fork; base of latter considerably beyond middle cross-vein, its posterior branch half the length of anterior.

Hab.—Knapsack Gully, Blue Mountains (Masters). One specimen in September.

229. CHIRONOMUS PULCHER, sp.n. (Pl. XI., fig. 3).

♀.—Length of antennæ......	0·014 inch	...	0·35 millimètre.
Expanse of wings........	0·075 × 0·027	...	1·89 × 0·68
Size of body..............	0·075 × 0·016	...	1·89 × 0·40

Antennæ brownish-green, basal joint more yellowish. Head green, the face, clypeus, and palpi brownish-green. Thorax

prasinous, with three olivaceous stripes more or less tinged with tawny; pleuræ, pectus and scutellum prasinous, the latter fringed with short yellow hairs; metanotum prasinous anteriorly, livid posteriorly. Halteres prasinous. Abdomen short, robust, æruginous, all segments with a narrow paler border posteriorly, clothed with a sparse pale yellow pubescence; terminal lamellæ yellow. Coxæ and femora prasinous. Tibiæ and tarsi of fore legs sooty brown. Tibiæ and metatarsi of intermediate and hind legs somewhat fulvous, their tips and all remaining tarsal joints sooty brown. In fore legs metatarsus $\frac{1}{3}$ longer than tibia. Wings the length of whole body, beautifully opaline; costal, first and third longitudinal, middle cross-vein, and basal half of fourth longitudinal veins distinct, yellow. Costal and third longitudinal veins meeting considerably before apex of wing; auxiliary vein indistinctly joining costa about mid-way between middle cross-vein and tip of first longitudinal vein; second longitudinal vein scarcely distinguishable, reaching costa at a point $\frac{1}{3}$ the distance from tip of first longitudinal to tip of costal vein; fourth longitudinal pale, almost reaching wing-margin, its tip situated about mid-way between tip of costal and that of anterior branch of fifth longitudinal fork; base of latter lying somewhat beyond middle cross-vein, its posterior branch somewhat more than half the length of anterior.

Hab.—Summer Hill, near Sydney (Mr. Cyril Haviland). April.

B. Thorax pale without distinct stripes.

230. Chironomus seorsus, sp.n. (Pl. xi., fig. 4).

♀.—Length of antennæ......	0·025 inch	...	0·62 millimètre.
Expanse of wings........	0·085 × 0·025	...	2·14 × 0·62
Size of body..............	0·070 × 0·016	...	1·77 × 0·40

Antennæ ochreous-brown, with long brownish verticils; basal joint deep brown. Head ochreous-brown; face and clypeus deep brown. Palpi yellow. Thorax yellow, levigate, with three

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longitudinal rows of yellow hairs; pleuræ, pectus, scutellum, and metanotum yellow, the latter tinged with brownish. Halteres pale yellow. Abdomen short, yellowish-green, densely clothed with short pale yellow hairs. Legs yellow, densely haired. Tibial spurs black. In fore legs metatarsus almost twice length of tibia. Wings longer than body, pellucid, almost hyaline, with rosy and aurichalceous reflections; costal, first and third longitudinal, and basal portion of fourth and whole of fifth longitudinal vein distinct, brownish-yellow. Costal and third longitudinal veins meeting at apex of wing; auxiliary vein very indistinct, joining costa a short distance beyond middle cross-vein; second longitudinal vein scarcely determinable, running close to first longitudinal; fourth longitudinal very pale and indistinct, disappearing entirely a short distance before wing-margin, its tip nearer to tip of costal than to that of anterior branch of fifth longitudinal fork; posterior branch of latter less than $\frac{2}{5}$ the length of anterior branch.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). January.

231. Chironomus orarius, sp.n.

♂.—Length of antennæ........	0·037 inch	...	0·92 millimètre.
Expanse of wings.........	0·075 × 0·020	...	1·89 × 0·50
Size of body...............	0·090 × 0·016	...	2·27 × 0·40
♀.—Length of antennæ........	0·025 inch	...	0·62 millimètre.
Expanse of wings..........	0·105 × 0·025	...	2·67 × 0·62
Size of body................	0·105 × 0·016	...	2·67 × 0·40

♂ and ♀.—Entirely yellow, except that flagellar joints in ♂ antennæ ochreous-brown or light brown. Antennæ in ♀ with long pale yellow verticils. Thorax with three longitudinal rows of long yellow hairs. Abdomen with slightly greenish tint in ♀; in both sexes about three times the length of thorax; densely clothed with pale yellow hairs; anal joint and holding-forceps of

♂ narrower than terminal segment. Tibial spurs black. In fore legs the metatarsus twice the length of tibia. Wings in ♂ shorter, in ♀ longer, than the body; pellucid in ♂, hyaline in ♀, with weak reflections; veins yellow. Costal and third longitudinal veins meeting slightly before apex of wing; auxiliary vein very indistinct, especially in ♂, joining costa a little beyond middle cross-vein; second longitudinal vein most indistinct in ♂, clearly visible in ♀, very near first longitudinal; fourth longitudinal very pale beyond middle cross-vein, almost reaching wing-margin, its tip nearer to tip of costal than to that of anterior branch of fifth longitudinal fork; posterior branch of latter about half the length of anterior branch.

Hab.—Middle Harbour, near Sydney (Skuse); Berowra, N.S.W. (Masters). Abundant in September.

Obs.—Very closely allied to the last, but I think distinct.

C. Thorax brown or black without distinct stripes.

a. Wings unspotted.

232. Chironomus erebeus, sp.n. (Pl. xi., fig. 5).

♀.—Length of antennæ........	0·030 inch	...	0·76 millimètre.
Expanse of wings	0·160 × 0·040	...	4·06 × 1·01
Size of body................	0·210 × 0·033	...	5·33 × 0·84

Antennæ brown, with brown verticils; first joint of scapus black. Head black, glabrous. Palpi brown, and with clypeus densely covered with brown hairs, those on latter longer. Thorax black, sub-nitidous, glabrous; pleuræ and scutellum brownish-black, latter fringed with black hairs; metanotum black. Halteres yellow, sometimes slightly brownish at base. Abdomen more than twice the length of thorax, black, sub-nitidous, sparingly clothed with short black hairs; lamelli of ovipositor black. Coxæ deep brown, slightly ochreous at apex; trochanters ochreous. Femora and tibiæ black. Tarsi almost ochreous-brown, slightly infuscated. In fore legs tibia twice the length of metatarsus. Wings hyaline, smoky along anterior border, iridescent; costal,

first and second longitudinal veins, middle cross-vein and basal half of fourth longitudinal vein brown. Costal and third longitudinal veins meeting at a point much before apex of wing; auxiliary vein joining costa nearly opposite tip of posterior branch of fifth longitudinal fork; second longitudinal vein reaching margin midway between tips of first and third longitudinal veins; fourth longitudinal vein nearly reaching wing-margin, its tip situated at a point considerably nearer to tip of anterior branch of fifth longitudinal fork than to that of costal vein; base of fifth longitudinal fork lying somewhat beyond middle cross-vein, its posterior branch ½ the length of anterior.

Hab.—Woronora, N.S.W. (Skuse). Two specimens. September.

233. Chironomus Tepperi, sp.n. (Pl. xi., fig. 6).

♀.—Length of antennæ......	0·027 inch	...	0·68 millimètre.
Expanse of wings........	0·165 × 0·045	...	4·18 × 1·13
Size of body..............	0·200 × 0·035	...	5·08 × 0·88

Antennæ black; first joint of scapus somewhat ochreous, more or less hoary. Head, clypeus, and palpi brown, with yellow hairs. Thorax black, opaque, hoary, with three longitudinal rows of yellow hairs; pleuræ, pectus, scutellum and metanotum black, hoary; scutellum fringed with long yellow hairs. Halteres pale yellow. Abdomen more than twice the length of thorax, dusky brown or black, levigate, a little hoary, tolerably clothed with pale yellow hairs; lamellæ of ♀ ovipositor ochreous. Legs with a yellow pubescence. Tibial spurs black. Femora and tibiæ brownish-ochreous, the apex of former and base and apex of latter dusky brown. Metatarsi brownish-ochreous, their tips and remaining tarsal joints dusky brown. In fore legs metatarsus not ½ longer than tibia. Wings about the length of abdomen, hyaline, a little iridescent, with ochre-yellow veins. Costal and third longitudinal veins meeting a little before apex of wing; auxiliary vein extremely indistinct, apparently terminating near costa a short distance past middle cross-vein; second longitudinal vein very pale and indistinct, joining costa at a point ⅕

the distance from tip of first longitudinal vein to tip of third longitudinal; fourth longitudinal very pale and indistinct beyond cross-vein, disappearing some distance from wing-margin, its tip situated at a point much nearer to tip of third longitudinal vein than to that of anterior branch of fifth longitudinal fork; base of latter lying a little beyond middle cross-vein, its posterior branch $\frac{2}{3}$ the length of anterior.

Hab.—Mount Lofty and Adelaide, South Australia (Mr. T. P. O. Tepper). June and October. Two specimens in the collection of the Adelaide Museum.

234. CHIRONOMUS FLUVIATICUS, sp.n.

♂.—Length of antennæ	0·050 inch	...	1·27 millimètres.
Expanse of wings........	$0·105 \times 0·023$	...	$2·67 \times 0·58$
Size of body..............	$0·160 \times 0·020$	...	$4·06 \times 0·50$

Antennæ light and somewhat bronzy, brown; first joint of scapus deep brown or black, second and few following flagellar joints ochreous-yellow. Head deep brown or black, with some short brownish hairs. Clypeus and palpi deep brown or black, with a brown pubescence. Thorax deep brownish-black, dull, traversed (when viewed at a certain obliquity) by two longitudinal more or less hoary narrow stripes, extending from humeri to scutellum, sparingly beset with yellow hairs; also an intermediate double row of short hairs reaching to middle of thorax; pleuræ, pectus, scutellum and metanotum black, the scutellum fringed with yellow hairs. Halteres yellow. Abdomen very slender, rather more than three times the length of thorax, deep dull black, rather densely clothed with moderately long yellow hairs; anal joint black, forceps brown. Coxæ black. Remaining joints sordid ochreous-yellow, tips of femora and tibial spurs dark brown. In fore legs metatarsus $\frac{2}{7}$ longer than tibia. Wings shorter than abdomen, pellucid, with a very pale bluish tint; veins very pale brownish-yellow; dull pale brassy reflections. Costal and third longitudinal veins meeting a short distance before apex of wing;

auxiliary vein scarcely visible towards its tip, apparently terminating about opposite middle of posterior branch of fifth longitudinal fork; second longitudinal vein tolerably distinct, pale, joining costa at a point somewhat more than $\frac{1}{3}$ the distance from tip of first longitudinal to tip of third longitudinal; fourth longitudinal pale, almost reaching margin, its tip situated somewhat nearer to tip of third longitudinal than to that of anterior branch of fifth longitudinal fork; base of latter lying a little beyond middle cross-vein, its posterior branch $\frac{1}{2}$ the length of anterior.

Hab.—Nepean River, N.S.W. (Skuse). September.

235. Chironomus subvittatus, sp.n.

♂.—Length of antennæ......	0·045 inch	...	1·13 millimètres.
Expanse of wings........	0·090 × 0·022	...	2·27 × 0·55
Size of body..............	0·120 × 0·020	...	3·04 × 0·50

Antennæ ochreous-brown with yellow plumes; basal joint black. Head, face, and clypeus black. Palpi ochreous-brown. Thorax pitch-brown, nitidous, with three indistinct black stripes; three longitudinal rows of yellow hairs; pleuræ and pectus black; scutellum pitch-brown; metanotum black. Halteres pale yellow. Abdomen rather more than twice the length of thorax, black, sub-nitidous, clothed with tolerably long yellow hairs; anal joint and forceps black. Legs pale ochreous-yellow; last four joints of tarsi in fore legs, and last three in intermediate and hind legs somewhat infuscated. In fore legs metatarsus about twice the length of tibia. Wings rather shorter than abdomen, hyaline, with brassy reflections; costal, first and second longitudinal veins, middle cross-vein, and basal half of fourth longitudinal brownish-ochreous. Costal and third longitudinal veins meeting a short distance before apex of wing; auxiliary vein very indistinct towards tip, joining costa about opposite middle of posterior branch of fifth longitudinal fork; second longitudinal vein pale, fairly distinct, running nearer to third than to first longitudinal vein, reaching costa at a point about $\frac{1}{3}$ the distance from tip of first to tip of third longitudinal vein; fourth longitudinal vein pale beyond

cross-vein, not quite reaching wing-margin, its tip situated about midway between tips of third longitudinal and anterior branch of fifth longitudinal fork; base of latter lying opposite middle cross-vein, its posterior branch half the length of anterior.

Hab.—Walcha, N.S.W. (Mr. J F. Schofield). April.

236. Chironomus oresitrophus, sp.n. (Pl. xi., figs. 7 and 8).

♂.—Length of antennæ......	0·035 inch	...	0·88 millimètre.
Expanse of wings........	0·090 × 0·020	...	2·27 × 0·50
Size of body..............	0·100 × 0·020	...	2·54 × 0·50
♀.—Length of antennæ......	0·022 inch	...	0·55 millimètre.
Expanse of wings........	0·097 × 0·027	...	2·44 × 0·68
Size of body..............	0·100 × 0·020	...	2·54 × 0·50

♂ and ♀.—Antennæ, head, and palpi brown; basal joint of antennæ more or less tinged with ochreous. Thorax brown, with three longitudinal rows of brown hairs; pleuræ and pectus brown; scutellum yellowish-brown, sometimes ochreous-yellow; metanotum dark brown. Halteres brown or yellowish-brown. Abdomen in ♂ rather more than twice the length of thorax, much shorter in ♀; densely covered with brownish hair; brown, the segments sometimes indistinctly bordered posteriorly with ochreous; ♂, anal joint and forceps brown; ♀, lamellæ of ovipositor ochre-yellow. Legs sordid ochreous-brown, densely clothed with brownish hairs, femora indistinctly darker at apex. Tibial spurs dark brown or black. In fore legs metatarsus about $\frac{1}{5}$ longer than tibia. Wings longer than abdomen, almost hyaline, a little iridescent, with distinct brown veins. Costal and third longitudinal veins meeting at apex of wing; auxiliary vein reaching costa almost opposite base of fifth longitudinal fork; second longitudinal vein indistinct, joining costa at a point about $\frac{1}{3}$ the distance from tip of first longitudinal to that of third longitudinal; latter vein much arcuated posteriorly; fourth longitudinal vein indistinct beyond cross-vein, almost reaching margin at a point about $\frac{1}{3}$ the distance from tip of third longitudinal to that

of anterior branch of fifth longitudinal fork; base of latter lying considerably beyond middle cross-vein, its posterior branch about $\frac{1}{2}$ the length of anterior.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). January.

237. CHIRONOMUS VESPERTINUS, sp.n.

♂.—Length of antennæ........	0.037 inch ...	0·92 millimètre.
Expanse of wings.........	$0{\cdot}090 \times 0{\cdot}020$ ...	$2{\cdot}27 \times 0{\cdot}50$
Size of body................	$0{\cdot}085 \times 0{\cdot}015$ ...	$2{\cdot}14 \times 0{\cdot}38$

Antennæ bronzy-brown; basal joint deep brown. Head black. Palpi brownish-ochreous. Thorax black, opaque, more or less hoary, with three longitudinal rows of brownish hairs; pleuræ and pectus black; scutellum dark brown, sometimes ochreous-brown; metanotum black. Halteres dusky brown, basal half of the stem yellow. Abdomen about twice the length of thorax, deep umber-brown or black, moderately clothed with tolerably long yellowish hairs; anal joint deep umber-brown or black, narrow; forceps ochreous or ochreous-brown. Legs entirely ochreous-yellow, densely covered with long yellowish hairs. Tibial spurs deep brown or black. In fore legs metatarsus about $\frac{3}{7}$ longer than tibia. Wings rather longer than body, pellucid, with a weak brassy reflection; costal, first and third longitudinal veins, middle cross-vein, and basal portion of fourth longitudinal yellowish, distinct. Costal and third longitudinal veins meeting somewhat before apex of wing; auxiliary vein indistinct, joining costa about mid-way between origin of third and tip of first longitudinal vein; second longitudinal vein indistinct, joining costa a little past tip of first longitudinal; fourth longitudinal very pale beyond middle cross-vein, slightly bent, scarcely reaching margin, its tip situated at a point $\frac{1}{3}$ the distance from tip of third longitudinal to that of anterior branch of fifth longitudinal fork; posterior branch of the latter about $\frac{2}{3}$ the length of anterior branch.

Hab.—National Park, near Sydney, N.S.W. (Skuse). Plentiful in July.

238. Chironomus brevis, sp.n. (Pl. xi., fig. 9).

♀.—Length of antennæ......	0·017 inch	...	0·42 millimètre.
Expanse of wings........	0·057 × 0·015	...	1·44 × 0·38
Size of body..............	0·050 × 0·010	...	1·27 × 0·25

Antennæ light brownish-ochreous; basal joint very pale ochreous-yellow. Head, clypeus, and palpi brownish-ochreous, the latter palest. Thorax umber-brown, with two longitudinal rows of brown hairs; pleuræ and pectus umber-brown, more or less tinged with pale ochreous-yellow; scutellum ochreous-brown, fringed with long brown hairs; metanotum dusky umber-brown. Halteres dusky, base of the stem pale. Abdomen short, robust, dusky umber-brown, rather densely clothed with a short brown pubescence; lamellæ of ovipositor ochreous-yellow. Legs pale ochreous-yellow, with a pale pubescence. Tibial spurs black or deep brown. In fore legs metatarsus rather more than $\frac{1}{4}$ longer than tibiæ. Wings longer than body, pellucid, with brassy reflections; costal and first and third longitudinal veins light brown, distinct, remaining veins fairly distinguishable. Costal and third longitudinal veins meeting at apex of wing; auxiliary vein very pale, joining costa somewhat beyond middle cross-vein; second longitudinal scarcely distinguishable, running close to first longitudinal; fourth longitudinal much paler beyond middle cross-vein, very little bent, its tip nearer to tip of costal than to tip of anterior branch of fifth longitudinal fork; posterior branch of the latter $\frac{1}{2}$ the length of anterior branch.

Hab.—Sydney (Skuse). A single specimen.

b.—Wings spotted.

239. Chironomus nubifer, sp.n.

♂.—Length of antennæ.......	0·055 inch	...	1·39 millimètres.
Expanse of wings.........	0·140 × 0·040	...	3·55 × 1·01
Size of body..............	0·200 × 0·033	...	5·08 × 0·84
♀ —Length of antennæ	0·025 inch	...	0.62 millimètre.
Expanse of wings.........	0·140 × 0·040	....	3·55 × 1·01
Size of body..............	0·120 × 0·027	...	3·04 × 0·68

♂ and ♀.—Antennæ smoky-brownish; first joint of scapus deep black, somewhat hoary when viewed in a certain light. Head and clypeus brown or black. Palpi brown. Thorax greyish-black, with a very fine median furrow beset with short yellow hairs and two parallel lateral rows of rather long yellow hairs; pleuræ, pectus, scutellum and metanotum deep brown or black, scutellum fringed with long yellow hairs. Halteres yellow. Abdomen in ♂ about three times, in the ♀ about twice, the length of thorax, deep brownish-black, densely clothed with yellow hairs; ♂ anal joint and forceps deep brownish-black. Legs very pale ochreous-yellow, densely clothed with pale yellow hairs, particularly long and dense in the fore tarsi; coxæ brown, and femora generally with a more or less brownish tinge. In fore legs metatarsus in ♂ about $\frac{1}{4}$, in the ♀ $\frac{1}{3}$, longer than tibia. Tibial spurs black or deep brown. Wings in ♂ longer, in ♀ shorter, than the abdomen, pellucid, with several small pale violaceous markings; one enveloping the fourth longitudinal vein immediately beyond cross-vein, a second between third and fourth longitudinal veins mid-way to apex of wing, a third at apex, one below each of these between fourth longitudinal vein and anterior branch of fifth longitudinal, another at base of fork of latter, and lastly two more behind fifth longitudinal; veins ochreous-yellow. Costal and third longitudinal veins meeting a short distance before apex of wing; auxiliary vein very pale, joining costa opposite middle of posterior branch of fifth longitudinal fork; second longitudinal vein indistinct, joining costa at a point $\frac{1}{3}$ the distance from tip of first to that of third longitudinal; fourth longitudinal vein very pale beyond cross-vein, almost reaching margin, its tip situated almost mid-way between tips of third longitudinal and anterior branch of fifth longitudinal fork, somewhat nearer former; base of fifth longitudinal fork lying somewhat beyond middle cross-vein, its posterior branch about $\frac{1}{2}$ the length of anterior.

Hab.—Wheeny Creek, Hawkesbury District, Berowra, Hexham, Armidale and Sydney, N.S.W. (Skuse). January.

It is not possible to ascertain from the descriptions to what genera of the Chironomina the following should be referred, mention of most of the characters essential to notice being entirely omitted. Those described by Walker all fall into the section with naked wings, while *C. conjunctus*, *C. oppositus*, *C. applicatus*, and *C. alternans* have the tibia longer than the metatarsus in the fore-legs. I do not believe that *C. conjungens*, *C. opponens*, *C. reflectus*, and *C. proximus*, named by Walker in his "Notes," have ever been described.

240. Chironomus alternans, Walker.

Chironomus alternans, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 423 (Div. 1, Alæ nudæ. Sub-div. 1, Halteres pallidi).

"♂.—*Testaceus; antennæ fuscæ; thorax vittis duabus dorsalibus lateribusque viridibus; abdomen viride, pubescens, vitta interrupta fusca dorsali; pedes virides, pubescentes, tibiis et tarsorum articulis apice fuscescentibus; alæ limpidæ, venis testaceis, litura discali sub-obscuriore.*

"Testaceous. Antennæ brown. Thorax green on each side, and with two green dorsal stripes. Abdomen green, pubescent, with an interrupted brown dorsal stripe. Legs green, long, slender, pubescent; tips of the tibiæ and of the joints of the tarsi brownish; fore-tibia very much longer than the fore-metatarsus. Wings limpid; veins testaceous; discal mark a little darker, not distinct. Length of the body 4 lines, of the wings 6 lines.

Hab.—"New South Wales."

241. Chironomus applicatus, Walker.

Chironomus applicatus, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 424 (Div. 1, Alæ nudæ. Sub-div. 1, Halteres pallidi).

"♀.—*Canus; antennæ fuscæ; thorax fusco trivittatus; abdomen fuscum, fasciis ventreque canis; pedes viridescentes, sub-pubescentes, tarsis fere totis femoribusque tibiisque apice fuscescentibus; alæ sub-cinereæ, venis fuscis, litura discali obscuriore.*

"Hoary. Antennæ brown, testaceous at the base. Thorax with three brown stripes, the lateral pair indistinct. Abdomen brown, with a hoary band on the hind border of each segment; under side hoary. Legs greenish, long, slender, slightly pubescent; tarsi, except towards the base and tips of the femora and of the tibiæ, brownish; fore tibia very much longer than the fore metatarsus. Wings greyish; veins brown; discal mark darker brown. Halteres testaceous. Length of the body, 4½ lines; of the wings, 7 lines.

Hab.—"Van Diemen's Land."

242. Chironomus duplex, Walker.

Chironomus duplex, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 424 (Div. 1. Alæ nudæ. Sub-div. 1. Halteres pallidi).

"♀.—*Albido-viridis; antennæ testaceæ, fusco fasciatæ; thorax vittis tribus obscure cinereo-fuscis; abdomen fuscum, albido tomentosum, fasciis lateribusque albido-viridibus; pedes viridescentes, tarsorum articulis apice fuscis, alæ limpidæ, venis halteribusque testaceis, litura discali fusca.*

"Whitish-green. Antennæ testaceous; sutures and tips brown. Thorax with three dark greyish-brown stripes. Abdomen above brown, with whitish tomentum; sides and hind borders of the segments whitish-green. Legs greenish, long, slender; tips of the joints of the tarsi brown. Wings limpid; veins testaceous; discal mark brown. Halteres testaceous. Length of the body, 4½ lines; of the wings, 7 lines.

Hab.—"Van Diemen's Land."

243. Chironomus imitans, Walker.

Chironomus imitans, Walk., Insecta Saundersiana, Vol I. Diptera, 1856, p. 425 (Div. 1. Alæ nudæ. Sub-div. 1. Halteres pallidi).

"♂.—*Pallide viridis; antennæ fuscæ; thorax vittis tribus pectorisque disco nigro-cinereis; pedes tibiis et tarsorum articulis apice fuscescentibus; alæ limpidæ, venis albidis, litura discali fusca.*

"Pale green. Antennæ brown. Thorax with three blackish-grey stripes. Pectus with a blackish-grey disc. Abdomen with a broad blackish-grey band on the fore border of each segment. Legs pale green, long, slender; tips of the tibiæ and of the joints of the tarsi brownish. Wings limpid; veins whitish; discal mark brown. Length of the body, 4 lines; of the wings, 6 lines.

Hab.—"Van Diemen's Land."

244. Chironomus oppositus, Walker.

Chironomus oppositus, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 425 (Div. 1, Alæ nudæ. Sub-div. 1. Halteres pallidi).

"♂.—*Pallide testaceus aut viridis; antennæ fuscæ; thorax vittis tribus rufescentibus; abdomen pubescens, viride fasciis fuscis; pedes pallide virides pubescentes, tarsis apice fuscis; alæ limpidæ, venis albidis, litura discali fusca.*

"Pale testaceous, green (?) while living. Antennæ brown. Thorax with three reddish stripes. Abdomen pubescent, green, with a brown band on each segment. Legs pale green, long, slender, pubescent; tarsi brown towards the tip; fore tibia very much longer than the fore metatarsus. Wings limpid; veins whitish; discal transverse vein brown. Length of the body 3½ lines; of the wings 5 lines.

Hab.—"Van Diemen's Land."

245. Chironomus conjunctus, Walker.

Chironomus conjunctus, Walk., Insecta Saundersiana, Vol. I. Diptera, 1856, p. 425 (Div. 1. Alæ nudæ. Sub-div. 1. Halteres pallidi).

"♂ and ♀.—*Viridis; antennæ pallide fuscæ; thorax vittis tribus rufescentibus; pedes pallide virides, tarsis apice fuscis;*

alæ limpidæ, venis pallidis, litura discali nulla. ♂.—*Abdomen pubescens apice fuscum.*

"Green. Antennæ pale brown. Thorax with three reddish stripes. Legs pale green, slender; tarsi brown towards the tips; fore tibia much longer than the fore metatarsus. Wings limpid; veins pale; no discal mark. ♂.—Abdomen pubescent, brown at the tip, much longer than that of the ♀. Length of the body 2-2½ lines; of the wings 3½ lines.

Hab.—"Van Diemen's Land."

246. Chironomus australis, Macquart.

♂.—*Chironomus australis,* Macq., Diptères Exotiques, 2nd Suppl. 1847, p. 9; ♀, 4th Suppl. 1850, p. 12.

"♂.—*Thorace rufescente, vittis fuscis; scutello rufescente. Abdomine nigricante, incisuris rufis. Pedibus rufis. Alis pallidis.*

"Antennæ with brownish plumes. Metathorax black, with a light grey down. The tawny rings to the incisions of the abdomen narrow. Extremity of femora and base of the tibiæ brownish; a little brown at the extremity of the tibiæ and the joints of the tarsi; intermediate and hind tibiæ finely haired beneath. Wings with the transverse vein a little brownish. Long. 3½ × 1.

Hab.—"Tasmania."

Obs.—Macquart says that the ♀ differs only by the ordinary sexual characters.

Genus 2. Orthocladius, V.d. Wulp.

Orthocladius, V.d. Wulp, Tijd. Entom. 1873-74, XVII. p. 132.

Antennæ 2-+12-jointed in ♂, 2-+5-jointed in ♀. Thorax with three stripes. Wings naked. Third longitudinal vein straight or only a little curved, going nearly to end of anterior margin. Costal vein sometimes extending a little beyond tip of third longitudinal. Posterior branch of fifth longitudinal fork straight or a little bent. Legs unicoloured; or only darker at articulations. In fore legs metatarsus considerably shorter than tibia. ♂ forceps slender.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance.							
		Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
247	*O. annuliventris* ...	67	33	...	...	66	15	15	4	...	...	...	...
248	*O. numerosus* ..	67	33	...	...	67	10	15	8	...	...	...	...
249	*O. venustulus* ...	61	39	...	...	73	5	21	1	...	...	...	...
250	*O. insolidus*	67	33	...	...	54	0	27	19	...	...	...	...
251	*O. pullulus*	1	...	66	34	...	...	...	...	54	10	20	16

247. Orthocladius annuliventris, sp.n. (Pl. xi., fig. 10).

♂.—Length of antennæ...... 0·035 inch ... 0·88 millimètre.
Expanse of wings........ 0·090 × 0·023 ... 2·27 × 0·58
Size of body.............. 0·110 × 0·020 ... 2·79 × 0·50

Antennæ black, plumes somewhat bronzy towards tips. Head, clypeus, and palpi black, the latter sometimes more brownish. Thorax black, nitidous, glabrous, with no trace of stripes; pleuræ, pectus, scutellum, and metanotum black, the last two opaque. Halteres pitch-brown. Abdomen about twice and half the length of thorax, black, nitidous, whole of the first segment, anterior third of second, and anterior half of fourth and fifth segments pale brownish-yellow or ochreous; sparingly covered with short brownish hairs; anal joint and forceps short. Legs pitch-brown, genua ochreous-yellow, and fore and intermediate tibiæ with a very broad ring of white near the base. In fore legs tibia nearly twice the length of metatarsus. Wings as long as abdomen, hyaline,

with a more or less brassy iridescence; veins light umber-brown. Third longitudinal vein meeting the costa some distance before apex of wing; auxiliary vein pale, joining costa opposite middle cross-vein; costal vein extending beyond tip of third longitudinal, about $\frac{1}{5}$ the distance to tip of fourth longitudinal vein; latter almost reaching margin, its tip situated nearer to tip of costa than to that of anterior branch of fifth longitudinal fork; second longitudinal vein pale, reaching costa about midway between tips of first and third longitudinal veins; base of fifth longitudinal fork lying considerably beyond middle cross-vein, its posterior branch $\frac{1}{2}$ the length of anterior.

Hab.—Blue Mountains (Masters and Skuse); Sydney (Skuse). September to January.

Obs.—The white rings on the anterior two pairs of legs at once distinguish this species. Van der Wulp says with reference to the legs of the species of this genus, "Pooten eenkleurig, hoogstens aan de gewrichten donker geteekend," so the above seems a peculiar exception to the general rule.

248. ORTHOCLADIUS NUMEROSUS, sp.n. (Pl. XI., fig. 11).

♂.—Length of antennæ......	0·035 inch	...	0·88 millimètre.
Expanse of wings........	0·075 × 0·017	...	1·89 × 0·42
Size of body..............	0·085 × 0·015	...	2·14 × 0·38

Antennæ black; plumes somewhat bronzy at the tips. Head and clypeus black. Palpi deep dusky brown. Thorax black, levigate, with two longitudinal rows of black hairs; pleuræ, pectus, and metanotum black, levigate. Scutellum pitch-brown, fringed with black hairs. Halteres pitch-brown. Abdomen more than twice the length of thorax, deep black, opaque, clothed with brown hairs: anal joint and forceps black. Legs light greyish-brown to pitch-brown, with brownish hairs. In fore legs tibia $\frac{1}{3}$ longer than metatarsus. Wings as long or longer than abdomen, pellucid, with a pale bluish tint, and a brassy iridescence; costal and first and third longitudinal veins pale greyish-yellow. Auxiliary vein

pale, indistinct, joining costa about mid-way between middle cross-vein and tip of first longitudinal; third longitudinal vein joining costa very much before apex of wing; costal vein extending beyond third longitudinal vein almost $\frac{1}{3}$ distance from that to tip of fourth longitudinal; the tip of latter indistinctly reaching wing-margin, situated considerably nearer to tip of third longitudinal than to that of anterior branch of fifth longitudinal fork; second longitudinal vein pale, joining costa somewhat before mid-way between tips of first and third longitudinal veins; base of fifth longitudinal fork lying much beyond middle cross-vein, and almost opposite the tip of auxiliary vein, its posterior branch $\frac{1}{2}$ the length of anterior.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). January.

249. ORTHOCLADIUS VENUSTULUS, sp.n. (Pl. XI., fig. 12).

♂.—Length of antennæ	0·032 inch	...	0·80 millimètre.
Expanse of wings........	0·065 × 0·017	...	1·66 × 0·42
Size of body..............	0·085 × 0·015	...	2·14 × 0·38

Antennæ light greyish-brown, plumes with pale reflections; first joint of the scapus deep brown or black, levigate, second pale yellow. Head and clypeus brownish-black. Palpi light greyish-brown. Thorax deep brownish-black, levigate, somewhat pruinose, with two longitudinal rows of brownish hairs; pleuræ pitch-brown; pectus dark brown or brownish-black; scutellum pitch-brown; metanotum black or deep brownish-black. Halteres pale yellow. Abdomen nearly three times length of thorax, pitch-brown, levigate, rather densely clothed with brown hairs; anal joint and forceps pitch-brown. Legs light greyish-brown to pitch-brown, densely pubescent. Wings about the length of abdomen, pellucid, with a delicate violaceous tint and brassy reflection, veins sordid pale ochreous. Costal and third longitudinal veins meeting immediately before apex of wing; auxiliary vein indistinctly joining costa opposite tip of posterior branch of fifth longitudinal fork; second longitudinal very pale, running close to first longitudinal, afterwards close to costa, terminating a little beyond tip

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of first longitudinal; fourth longitudinal very pale beyond cross-vein, almost reaching wing-margin, its tip situated at a point $\frac{1}{3}$ the distance from tip of third longitudinal to that of anterior branch of fifth longitudinal fork; base of latter lying somewhat beyond middle cross-vein, its posterior branch $\frac{1}{2}$ the length of anterior.

Hab.—Berowra, Hawkesbury district, N.S.W. (Masters).

250. Orthocladius insolidus, sp.n. (Pl. xi., fig. 13).

♂.—Length of antennæ........	0·025 inch	...	0·62 millimètre.
Expanse of wing...........	0·055 × 0·017	...	1·39 × 0·42
Size of body................	0·060 × 0·012	...	1·54 × 0·30

Antennæ light brown; plumes with yellowish reflections; basal joint deep brown or black. Head, clypeus and palpi brown or brownish-black. Thorax black, slightly ochreous at the humeri and brown longitudinally in front of scutellum, opaque; pleuræ brown, tinged with ochreous; pectus and metanotum black, levigate; scutellum ochreous. Halteres ochreous-yellow. Abdomen rather more than twice the length of thorax, umber brown, levigate, tinged with ochreous-brown beneath; clothed with yellowish hairs; anal joint and forceps short, deep brown. Legs light greyish-brown, with a pale pubescence; the genua yellow. In fore legs tibia about $\frac{1}{3}$ longer than metatarsus. Wings longer than abdomen, pellucid, with a delicate brown tint, and brassy reflections; costal, first and third longitudinal veins, and basal half of fourth longitudinal vein, pale greyish-brown. Auxiliary vein very indistinct, joining costa at a point almost mid-way between middle cross-vein and tip of first longitudinal vein; second longitudinal vein entirely wanting; third longitudinal joining costa very far from apex of wing and before tip of anterior branch of fifth longitudinal fork; costal vein extending beyond tip of third longitudinal $\frac{1}{3}$ the distance from that to tip of fourth longitudinal; latter almost reaching wing-margin, its tip situated at a point just before apex and at a point almost $\frac{2}{3}$ the distance from tip of third longitudinal to that of anterior branch of fifth longitudinal fork; base of latter lying somewhat beyond a point mid-way

between middle cross-vein and tip of first longitudinal, its posterior branch rather more than $\frac{1}{2}$ the length of anterior.

Hab.—Middle Harbour, Sydney (Skuse). August.

251. ORTHOCLADIUS PULLULUS, sp.n. (Pl. XI., fig. 14).

♀.—Length of antennæ......	0·008 inch	...	0·20 millimètre.
Expanse of wings......	0·042 × 0·015	...	1·06 × 0·38
Size of body..............	0·055 × 0·008	...	1·39 × 0·20

Antennæ brown. Head, face, and clypeus black or brownish-black. Palpi sordid ochreous-brown. Thorax black or brownish-black, levigate, with two longitudinal rows of pale hairs; pleuræ and pectus brownish-black; scutellum and metanotum black or brownish-black. Halteres brownish-black, the stem ochreous-brown. Abdomen twice the length of the thorax, black or brownish-black, sparingly pubescent. Legs pale greyish-yellow or sordid ochreous, with a pale pubescence. In fore legs tibia twice the length of metatarsus. Wings longer than abdomen, pellucid, almost hyaline, with a more or less brassy reflection; costal and first and third longitudinal veins brownish. Auxiliary vein very pale and indistinct, scarcely reaching the costa, disappearing opposite base of fifth longitudinal fork; second longitudinal vein extremely pale, joining the costa opposite tip of posterior branch of fifth longitudinal fork; third longitudinal vein joining costa much before apex of wing and opposite tip of anterior branch of fifth longitudinal; middle cross-vein very short and indistinct; costal vein extending beyond tip of third longitudinal $\frac{1}{5}$ the distance from that to tip of fourth longitudinal vein; latter scarcely sinuose, pale for whole of its length, directed posteriorly for whole of its length, almost reaching the wing-margin, its tip situated at a point considerably nearer to tip of anterior branch of fifth longitudinal fork than to that of third longitudinal; base of fifth longitudinal fork lying beyond middle cross-vein, its posterior branch not quite $\frac{1}{2}$ the length of anterior; both branches scarcely reaching posterior margin.

Hab.—Sydney (Skuse). September ?.

Genus 4. Doloplastus, gen.nov.

Antennæ 2- + 6-jointed in ♂, otherwise as in ♀ of preceding species. Wings naked. Third longitudinal vein nearly straight. Costal vein extending a little beyond tip of third longitudinal. Posterior branch of fifth longitudinal fork straight. Legs unicoloured. In fore legs metatarsus considerably shorter than tibia. ♂ forceps robust.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance.							
		Of the metatarsus in the hind feet.	Of the second tarsal joint of the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
252	*Dolop. monticola*...	67	33	...	...	61	14	14	11	...	...	...	...

252. Doloplastus monticola, sp.n. (Pl. xii., fig. 15).

♂.—Length of antennæ......	0·012 inch	...	0·30 millimètre.
Expanse of wings........	0·047 × 0·012	...	1·18 × 0·30
Size of body..............	0·075 × 0·012	...	1·89 × 0·30

Antennæ light brown or ochreous-brown. Head, face, and clypeus dark brown or brownish-black. Palpi ochreous-brown. Thorax dark brown or brownish-black, opaque, with two longitudinal rows of yellowish hairs; pleuræ and pectus dark brown or brownish-black; scutellum brown, sometimes brownish-ochreous; metanotum dark brown or brownish-black. Halteres brown or brownish. Abdomen twice to twice and a half the length of thorax, dark brown or brownish-black, opaque, with a short yellow pubescence; anal joint and forceps dark brown or brownish-black,

latter robust with short wide arm with a minute spine at its inner angle. Legs pitch-brown more or less tinged with ochreous. In fore legs tibia twice the length of metatarsus. Wings the length of the abdomen, semi-diaphanous, with a very pale brownish tint, the costal, first and third longitudinal veins, middle cross-vein and basal half of fourth longitudinal vein brownish-ochreous. Auxiliary vein most indistinct, apparently terminating near costa before origin of second longitudinal vein; latter also very pale and indistinct, joining costa mid-way between tips of first and third longitudinal veins; third longitudinal vein directed slightly upwards, joining much before apex of wing; costal vein extending beyond tip of third longitudinal nearly $\frac{1}{5}$ the distance from that to tip of fourth longitudinal; latter indistinct beyond cross-vein, almost reaching wing-margin, its tip at apex, and midway between tips of third longitudinal and anterior branch of fifth longitudinal fork; base of latter lying some distance beyond middle cross-vein, its anterior branch slightly arcuated at base, somewhat more than twice the length of posterior branch.

Hab.—Mount Kosciusko, N.S.W.

Genus 3. CAMPTOCLADIUS, V.d. Wulp.

Camptocladius, V.d. Wulp, Tijd. Entom. 1873-74, XVII. p. 133.

Antennæ 2-+12-jointed in ♂, 2-+5-jointed in ♀. Wings naked. Third longitudinal vein bent upwards, sometimes short and terminating considerably before end of anterior margin, or running for some distance close along anterior margin; consequently the first posterior cell very broad. Posterior branch of fifth longitudinal fork sinuose. Feet unicoloured, usually black. In fore legs metatarsus considerably shorter than tibia. Anal joint in ♂ short and broad; forceps broad, white or with white hairs.*

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* I have lately seen, in the collection of insects in the Australian Museum recently gathered by Mr. Helms at high elevations on Mount Kosciusko examples of two or three new species belonging to this genus.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance.							
		Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet	Of the second tarsal joint in the hind feet	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
253	*Camp. terjugus* ...	...	...	63	37	...	...	...	...	61	12	19	8
254	*Camp. vestitus* ...	...	...	66	34	...	...	...	..	59	13	19	9
255	*Camp. crassipennis*	...	...	67	33	...	...	...	...	60	0	34	6
256	*Camp. invenustulus*	...	...	67	33	...	...	..	...	56	0	33	11
257	*Camp. Macleayi*...	65	35	66	34	69	10	15	6	65	7	22	6

253. Camptocladius terjugus, sp.n. (Pl. xii., fig. 16).

♀.—Length of antennæ........ 0·017 inch ... 0·42 millimètre.
Expanse of wings.......... 0·075 × 0·020 ... 1·89 × 0·50
Size of body................ 0·090 × 0·017 ... 2·27 × 0·42

Antennæ dark brown; first joint of scapus pale brown or yellow. Head brown or ochreous-brown, with a few hairs along hinder margin of eyes. Clypeus and palpi brown, former sometimes with yellowish pubescence. Thorax yellow, often slightly tinged with brown, with three very prominent dusky castaneous-brown, sometimes almost black, stripes, confluent at posterior margin; intermediate stripe running whole length of thorax, suddenly narrowed a little below middle; a sparse row of dark brown hairs between stripes; pleuræ yellow, with a small, more or less dark brown indeterminate spot under origin of wing; pectus dusky brown; scutellum umber-brown, fringed with long dark

brown hairs; metanotum dusky castaneous-brown, almost black, with a yellow median line. Halteres deep castaneous-brown, almost fuliginous, stem yellow. Abdomen about twice the length of thorax, clothed with dark brown hairs, superior segments dusky castaneous-brown with a very narrow border of yellow posteriorly; last two segments same colour beneath; venter yellow. Legs deep umbrous-brown, trochanters and bases of femora yellow. In fore legs tibia $\frac{3}{8}$ longer than metatarsus. Wings rather longer than abdomen, yellow at root, pellucid, almost hyaline, iridescent; costal and first and third longitudinal veins brownish. Costal extending beyond third longitudinal about $\frac{1}{3}$ the distance to tip of fourth longitudinal; auxiliary vein indistinct, joining costa opposite base of fifth longitudinal fork; second longitudinal vein pale, reaching costa at a point about $\frac{3}{8}$ the distance from tip of first longitudinal to that of third longitudinal; middle cross-vein pale; fourth longitudinal vein pale, almost reaching the margin immediately below apex of wing; tip of third longitudinal rather nearer apex of wing than tip of anterior branch of fifth longitudinal fork; posterior branch of latter rather more than $\frac{1}{2}$ the length of anterior.

Hab.—Elizabeth Bay, near Sydney (Masters and Skuse). February.

Obs.—A very distinct and unmistakable insect.*

254. Camptocladius vestitus, sp.n.

♀.—Length of antennæ......	0·012 inch	...	0·30 millimètre.
Expanse of wings........	0·052 × 0·016	...	1·32 × 0·40
Size of body..............	0·065 × 0·012	...	1·66 × 0.30

Antennæ dark brown; basal joint ochreous-yellow. Head brown. Face, clypeus, and palpi ochreous or brownish-ochreous. Thorax ochreous-yellow or brownish-yellow, levigate, with three dark brown stripes; two longitudinal rows of yellowish hairs;

* Some specimens in the collection of the Australian Museum, recently obtained by Mr. Helms at an elevation of 5000 feet on Mount Kosciusko, belong to a closely related species.

pleuræ and pectus ochreous or brownish-yellow, the pectus sometimes brown; scutellum ochreous-brown; metanotum dark brown. Halteres yellow. Abdomen about twice the length of thorax, light umbrous-brown, with a yellowish pubescence. Legs ochreous-brown, sometimes darker. In fore legs tibia more than twice length of metatarsus. Wings longer than abdomen, hyaline, with a more or less roseous brassy reflection; costal, and first and third longitudinal veins brownish. Costal extending beyond tip of third longitudinal vein $\frac{1}{4}$ the distance from that to tip of fourth longitudinal; auxiliary vein extremely pale and indistinct, apparently joining costa midway between middle cross-vein and tip of first longitudinal vein, and opposite base of fifth longitudinal fork; second longitudinal vein very pale, running for some distance along costa before joining, terminating at a point nearly midway between tips of first and third longitudinal veins; middle cross-vein pale; fourth longitudinal pale for whole of its length, almost reaching wing-margin, directed a little posteriorly, terminating at apex, midway between tip of third longitudinal vein and anterior branch of fifth longitudinal fork; posterior branch of the latter $\frac{1}{2}$ the length of anterior branch.

Hab.—Elizabeth Bay, near Sydney (Skuse). Two specimens.

255. Camptocladius crassipennis, sp.n. (Pl. xii., fig. 17).

♀.—Length of antennæ......	0·012 inch	...	0·30 millimètre.
Expanse of wings........	0·065 × 0·020	...	1·66 × 0·50
Size of body..............	0·050 × 0·016	...	1·27 × 0·40

Antennæ entirely brown. Head brown. Clypeus and palpi ochreous or brownish. Thorax ochreous or brownish-yellow, dull, almost completely covered by three deep brown or black stripes, confluent at the scutellum, median line scarcely narrowing posteriorly, extending whole length of thorax, interstices of stripes very narrow, with a row of yellow hairs; pleuræ and pectus brown to dark brown, former sometimes tinged with ochreous; scutellum

pale ochreous-yellow ; metanotum dark brown. Halteres yellow. Abdomen scarcely twice the length of thorax, sordid brown, dull, more or less tinged with ochreous, sparingly clothed with yellowish hairs; lamellæ of ovipositor ochre-yellow. Legs more or less ochreous-brown, trochanters and bases of femora yellowish. In fore legs tibia twice the length of metatarsus. Wings longer than entire body, very angular at base, semi-diaphanous, having the appearance of ground glass, without iridescence ; costal, first and third longitudinal, and basal half of fourth longitudinal veins pale brownish. Costal and third longitudinal veins meeting much before apex of wing, considerably nearer to it than to tip of anterior branch of fifth longitudinal fork ; auxiliary vein extremely indistinct, apparently joining costa somewhat beyond middle cross-vein; second longitudinal vein indistinguishable or altogether wanting ; first and third longitudinal veins enormously thickened beyond middle cross-vein, third longitudinal attenuating towards tip ; fourth longitudinal very pale, directed posteriorly, not reaching margin, terminating considerably below apex of wing and much nearer to tip of anterior branch of fifth longitudinal than to that of third longitudinal ; base of fifth longitudinal fork lying much beyond middle cross-vein, its posterior branch more than ½ the length of anterior branch.

Hab.—Rodd Island, Port Jackson (Skuse). August.

Obs.—Possibly a marine species. It is very likely that some small insects seen by me in great numbers flying about the seaweed and damp rocks on another island at low water also belong to this species.

256. Camptocladius invenustulus, sp.n. (Pl. xii., fig. 18).

♀.—Length of antennæ........	0·010 inch	...	0·25 millimètre.
Expanse of wings.........	0·045 × 0·013	...	1·13 × 0·32
Size of body...............	0·042 × 0·008	...	1·06 × 0·20

Antennæ entirely ochreous-yellow or brownish-ochreous. Head dark brown. Face, clypeus and palpi ochreous-brown. Thorax

ochreous-brown, levigate, with three more or less distinct brown or brownish stripes, intermediate one sometimes paler than the rest; sometimes brownish immediately before scutellum; two longitudinal rows of short yellowish hairs; pleuræ and pectus dark brown; scutellum ochreous-brown or ochreous; metanotum dark brown. Halteres pale yellow. Abdomen about twice the length of thorax, rather dusky brown or lighter, tolerably clothed with pale hairs. Legs ochreous or brownish-ochreous. In fore legs tibia twice the length of tarsi. Wings somewhat longer than the entire body, hyaline, with a brassy reflection; costal, and first and third longitudinal veins brown or brownish. Costal extending far beyond tip of third longitudinal vein, reaching apex of wing and nearly reaching tip of fourth longitudinal vein; auxiliary vein indistinct, joining costa opposite base of fifth longitudinal fork and a short distance before tip of first longitudinal vein; second longitudinal entirely wanting; third longitudinal vein thickened towards its tip, running close to costa for a short distance before its tip, terminating opposite tip of anterior branch of fifth longitudinal fork; fourth longitudinal vein pale; base of fifth longitudinal fork lying opposite or scarcely beyond anterior extremity of middle cross-vein; its posterior branch somewhat more than ½ the length of anterior branch.

Hab.—Knapsack Gully, Blue Mountains, N.S.W. (Masters).

257. CAMPTOCLADIUS MACLEAYI, sp.n.

♂.—Length of antennæ......	0·037 inch	...	0·92 millimètre.
Expanse of wings.	0·080 × 0·020	...	2·02 × 0·50
Size of body...............	0·090 × 0·020	...	2·27 × 0·50
♀.—Length of antennæ......	0·015 inch	...	0·38 millimètre.
Expanse of wings........	0·080 × 0·029	...	2·02 × 0·73
Size of body..............	0·080 × 0·020	...	2·02 × 0·50

♂ and ♀.—Black, opaque. Antennæ (except basal joint) in ♂ dusky brown. Thorax with two longitudinal rows of short brown hairs. Halteres entirely blackish brown in ♂, brown with sordid

ochreous stem in ♀. Abdomen clothed with brown hairs; in ♂ two and a half, in the ♀ one and a half to twice the length of thorax; lamellæ of ♀ ovipositor often brown. Legs brownish-black; in ♀ often greyish-brown or pitch-brown, covered with brown hairs. In fore legs tibia about twice length of metatarsus. Wings in ♂ longer than abdomen, opaline, with pale veins; in ♀ about length of whole body, pellucid, with a very delicate violaceous tint; the costal and first and third longitudinal veins brownish; in both sexes with a brassy reflection. Costal extending beyond tip of third longitudinal, in ♂ about $\frac{1}{3}$, in ♀ about $\frac{1}{2}$ the distance to tip of fourth longitudinal vein; auxiliary vein joining costa midway between middle cross-vein and tip of first longitudinal vein; second longitudinal vein pale, in ♂ joining costa a little before a point midway between tips of first and third longitudinal veins, in ♀ about $\frac{1}{3}$ the distance between them; third longitudinal directed anteriorly, running close to costa towards its tip, terminating much before apex of the wing; fourth longitudinal vein pale, almost reaching margin, terminating below apex, and considerably nearer to tip of anterior branch of fifth longitudinal fork than to tip of third longitudinal; base of fifth longitudinal fork lying much beyond middle cross-vein, its posterior branch about $\frac{2}{3}$ the length of anterior.

Hab.—Sydney, and other localities in N.S.W. (Masters and Skuse). May to July.

Obs.—A very common insect in Sydney, often observable in immense clouds towards evening.

Genus 4. TANYTARSUS, V.d. Wulp.

Tanytarsus, V.d. Wulp, Tijd. Entom. 1873-74, XVII. p. 134.

Antennæ 2- + 12-jointed in ♂, 2- + 5-jointed in ♀. Wings haired. Third longitudinal vein straight or almost straight, running to end of anterior margin. Posterior branch of fifth longitudinal fork straight or only slightly bent downwards. In fore legs metatarsus longer than tibia. Forceps of ♂ slender.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance							
		Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
258	*T. montanus* ...	65	35	63	37	76	0	22	2	76	0	22	2
259	*T. inextentus* ...	64	36	64	36	75	8	13	4	71	7	17	5
260	*T. cereolus*	62	48	...	...	75	5	18	2	...	...	...	...
261	*T. communis* ...	...	...	63	37	...	...	...	...	75	7	12	6
262	*T. fuscithorax* ...	60	40	...	...	73	7	12	8	..	...	...	...
263	*T. Ogilbyi*	...	...	63	37	...	...	...	...	77	0	19	4
264	*T. modicus*	..	...	64	36	...	..	...	...	70	0	21	9

258. Tanytarsus montanus, sp.n. (Pl. xii., fig. 19).

♂.—Length of antennæ.......	0·047 inch	...	1·18 millimètres.
Expanse of wings.........	0·098 × 0·025	...	2·47 × 0·62
Size of body........... ...	0·130 × 0·017	...	3·30 × 0·42

♀.—Length of antennæ.......	0·025 inch	...	0·62 millimètre.
Expanse of wings.........	0·110 × 0·030	...	2·79 × 0·76
Size of body..	0·085 × 0·017	..	2·14 × 0·42

♂ and ♀.—Pale ochreous-yellow, levigate ; in ♂ basal joints of antennæ, head and clypeus, posterior half of thorax and pleuræ, pectus and metanotum light ferruginous-brown. Thorax with three longitudinal rows of yellow hairs, intermediate one terminating at the middle ; scutellum fringed with long yellow hairs. Abdomen in ♂ three times, and in ♀ twice, the length of the thorax,

clothed with yellow hairs, last few segments more or less tinged with brownish; ♂ anal joint and forceps somewhat narrower and longer than last abdominal segment; ♀ lamellæ pale yellow. Legs densely clothed with yellow hairs. Tibial spurs black or deep brown. In fore legs metatarsus somewhat more than $\frac{2}{7}$ longer than tibia. Wings in ♂ shorter than abdomen, in ♀ longer than whole body; hyaline, with brassy and roseous reflections, pubescent; veins yellow. Costal and third longitudinal vein meeting a short distance before apex of wing; auxiliary vein reaching costa considerably beyond middle cross-vein; first longitudinal vein joining costa before tip of anterior branch of fifth longitudinal fork, and a little beyond a point midway between middle cross-vein and tip of costa; second longitudinal wanting or so close to first longitudinal as to be indistinguishable; fourth longitudinal vein almost reaching the margin, its tip much nearer to tip of third longitudinal than to that of anterior branch of fifth longitudinal fork; base of latter lying somewhat beyond middle cross-vein, its posterior branch being about $\frac{1}{2}$ the length of anterior.

Hab.—Blue Mountains, N.S.W. (Masters and Skuse). January.

259. Tanytarsus inextentus, sp.n. (Pl. xii., figs. 20 & 21).

♂.—Length of antennæ......	0·042 inch	...	1.06 millimètres.
Expanse of wings........	0·095 × 0·025	...	2·39 × 0·62
Size of body..............	0·120 × 0·017	...	3·04 × 0·42
♀.—Length of antennæ......	0·017 inch	...	0·42 millimètre.
Expanse of wings..... .	0·090 × 0·025	...	2·27 × 0·62
Size of body..............	0·070 × 0·017	...	1·77 × 0·42

♂ and ♀.—Antennæ brownish-ochreous with yellow verticils; basal joint brown or brownish. Head, face, and clypeus brown or brownish. Palpi ochreous-yellow or brownish-yellow. Thorax yellow, with three longitudinal rows of yellow hairs, the intermediate one terminating at the middle; in ♂ rather

more than posterior half of thorax, also pleuræ, pectus and metanotum light ferruginous; scutellum yellow; no ferruginous in ♀. Halteres yellow. Abdomen in ♂ rather more than twice the length of thorax, in ♀ much shorter; prasinous, clothed with yellow hairs; ♂ anal joint and forceps short, brownish; ♀ lamellæ of ovipositor yellow. Legs pale ochreous-yellow. Tibial spurs black or deep brown. In fore legs metatarsus three times the length of tibia. Wings in ♂ as long as abdomen, in ♀ longer than whole body; hyaline, with delicate brassy and roseous reflections; veins yellow. Costal and third longitudinal veins meeting some distance before apex of wings; auxiliary vein extremely pale and indistinct, reaching costa about mid-way between middle cross-vein and tip of first longitudinal vein; first longitudinal reaching costa in ♂ a little beyond, in ♀ at a point mid-way between middle cross-vein and tip of costa; second longitudinal very indistinct, reaching costa at a point about $\frac{1}{3}$ the distance from tip of first longitudinal to that of third longitudinal; middle cross-vein pale, scarcely oblique, appearing as a continuation of basal portion of fourth longitudinal vein; third longitudinal appearing as a continuation of middle cross-vein; fourth longitudinal very pale and indistinct, bent considerably downwards at its base, almost reaching wing-margin, its tip situated nearer to tip of third longitudinal than to that of anterior branch of fifth longitudinal fork; base of latter lying somewhat beyond middle cross-vein, its posterior branch in ♂ more than $\frac{1}{2}$ the length of anterior, about $\frac{1}{2}$ the length in ♀.

Hab.—Sydney (Masters and Skuse). Very common.

Obs.—Very like *T. montanus*, but the length of the metatarsus of the fore legs affords a ready distinguishing character.

260. Tanytarsus cereolus, sp.n.

♂.—Length of antennæ......	0·045 inch	...	1·13 millimètres.
Expanse of wings.........	0·085 × 0·020	...	2·14 × 0·50
Size of body..............	0·100 × 0·015	...	2·54 × 0·38

Very pale waxen-yellow; flagellar joints of antennæ smoky. Thorax with three very indistinct pale fulvous stripes; posterior half of metanotum brown. Abdomen pale prasinous. Thorax levigate, with three longitudinal rows of yellow hairs, intermediate one terminating at the middle; scutellum with long yellow hairs. Halteres white. Abdomen nearly three times the length of thorax, densely clothed with yellow hairs; anal joint and forceps narrower than last abdominal segment. Legs clothed with very pale hairs. Tibial spurs black. In fore legs metatarsus $\frac{1}{5}$ longer than tibia. Wings rather longer than abdomen, pellucid, almost hyaline, with brassy reflections; veins yellow. Costal and third longitudinal veins meeting somewhat before apex of wing; auxiliary vein extremely pale and indistinct, reaching costa at a point somewhat beyond a point mid-way between middle cross-vein and tip of first longitudinal; first longitudinal vein reaching costa much nearer to tip of costa than to middle cross-vein; second longitudinal vein very pale, indistinct, running close to first longitudinal, joining costa at a point $\frac{1}{5}$ the distance from tip of first longitudinal to that of costa; fourth longitudinal vein very pale beyond cross-vein, little arcuated at base, almost reaching wing-margin, terminating at a point situated $\frac{1}{3}$ the distance from tip of third longitudinal vein to that of anterior branch of fifth longitudinal fork; base of latter lying some distance beyond middle cross-vein, its posterior branch about $\frac{1}{2}$ the length of anterior.

Hab.—Gosford, N.S.W. (Skuse). August.

261. TANYTARSUS COMMUNIS, sp.n.

♀.—Length of antennæ........	0·020 inch	...	0·50 millimètre.
Expanse of wing...........	0·095 × 0·030	...	2·39 × 0·76
Size of body................	0·090 × 0·017	...	2·27 × 0·42

Antennæ ochreous or brownish-ochreous. Head, face, clypeus and palpi ochreous-yellow to brownish-ochreous. Thorax, pleuræ, pectus and metanotum ochreous-yellow to brownish-ochreous, the

former levigate with three longitudinal rows of yellow hairs; intermediate row terminating at middle; scutellum yellow. Halteres pale yellow. Abdomen about twice the length of thorax, prasinous, with yellow hairs; lamellæ of the ovipositor ochreous-yellow. Legs ochreous-yellow. Tibial spurs black or deep brown. In the fore legs metatarsus three times the length of tibia. Wings longer than entire body, hyaline, with brassy and roseous reflections; the veins yellow. Costal and third longitudinal veins meeting considerably before apex of wing; auxiliary vein very pale and indistinct, reaching costa mid-way between middle cross-vein and tip of first longitudinal vein; first longitudinal vein reaching costa mid-way between middle cross-vein and tip of costa, and opposite middle of anterior branch of fifth longitudinal fork; second longitudinal vein very indistinct, reaching costa $\frac{1}{3}$ the distance from tip of first longitudinal to that of third longitudinal; middle cross-vein very little oblique, third longitudinal appearing as a continuation of it; fourth longitudinal very indistinct beyond cross-vein, nearly reaching wing-margin, its tip situated at a point about mid-way between tip of costa and that of anterior branch of fifth longitudinal fork; base of latter lying a little beyond the middle cross-vein, its posterior branch about $\frac{1}{2}$ the length of anterior.

Hab.—Berowra, Hexham Swamps and Sydney, N.S.W. (Masters and Skuse). April to July.

262. TANYTARSUS FUSCITHORAX, sp.n. (Pl. XII., fig. 22).

♂.—Length of antennæ......	— inch	...	— millimètre.
Expanse of wings........	0·080 × 0·017	...	2·02 × 0·42
Size of body..............	0·090 × 0·016	...	2·27 × 0·40

Basal joints of antennæ (remainder lost) brown. Head, face, and clypeus brown or brownish. Palpi ochreous-yellow. Thorax brownish, opaque, with three brown stripes, lateral ones dark; three longitudinal rows of yellow hairs; intermediate one

terminating at base of anterior stripe, the others continuing to scutellum; pleuræ, pectus, scutellum, and metanotum brown. Halteres white. Abdomen nearly three times the length of thorax, sordid yellowish-brown, clothed with yellow hairs; anal joint and forceps narrow. Legs whitish-ochreous. Spurs deep brown. In fore legs metatarsus about 2½ times the length of tibia. Wings longer than abdomen, hyaline, with a brassy reflection; veins pale yellow. Costal and third longitudinal veins meeting very much before the apex of wing; anxiliary vein very indistinct, reaching costa at a point about mid-way between middle cross-vein and tip of first longitudinal; first longitudinal reaching costa nearer to tip of costa than to middle cross-vein; second longitudinal very indistinct, reaching costa at a point nearly mid-way between tips of first and third longitudinal veins; middle cross-vein scarcely oblique, appearing as portion of third longitudinal; fourth longitudinal very indistinct, almost reaching wing-margin, its tip situated nearer to tip of third longitudinal vein than that of anterior branch of fifth longitudinal fork; base of latter lying somewhat beyond middle cross-vein, its posterior branch ½ the length of anterior.

Hab.—Narrabeen Lagoon, near Manly, N.S.W. (Skuse). October.

263. TANYTARSUS OGILBYI, sp.n.

♀.—Length of antennæ........	0·015 inch	...	0·38 millimètre.
Expanse of wings..........	0·075 × 0·020	...	1·89 × 0·50
Size of body................	0·055 × 0·015	...	1·39 × 0·38

Antennæ brownish-ochreous. Head, clypeus and palpi brownish-ochreous. Thorax yellowish-brown, levigate, with three longitudinal rows of hairs; intermediate one terminating about middle; pleuræ and pectus yellowish-brown; scutellum yellow; metanotum brownish-ochreous. Halteres pale prasinous, the stem ochreous. Abdomen about twice the length of thorax, prasinous, with a pale yellow pubescence; lamellæ of ovipositor ochreous. Legs

ochreous. Tibial spurs deep brown. In fore legs metatarsus more than twice the length of tibia. Wings longer than entire body, hyaline, with a brassy reflection; veins yellow. Costal and third longitudinal veins meeting considerably before apex of wing; auxiliary vein extremely indistinct, joining costa about mid-way between middle cross-vein and tip of first longitudinal vein; tip of latter situated considerably nearer to tip of costa than to middle cross-vein; latter very little oblique appearing as portion of third longitudinal vein; second longitudinal vein wanting; fourth longitudinal vein very indistinct beyond cross-vein, almost straight, nearly reaching wing-margin, its tip situated nearer to tip of third longitudinal than to that of anterior branch of fifth longitudinal fork; base of latter lying considerably beyond middle cross-vein, its posterior branch ½ the length of anterior.

Hab.—Sydney (Mr. J. Douglas Ogilby). April.

264. TANYTARSUS MODICUS, sp.n.

♀.—Length of antennæ......	0·012 inch	...	0·30 millimètre.
Expanse of wings........	0·057 × 0·015	...	1·44 × 0·38
Size of body..............	0·065 × 0·012	...	1·66 × 0·30

Antennæ light brown. Head and clypeus brown. Palpi brownish-ochreous. Thorax yellow, with three distinct brown stripes, lateral ones cuneate, anterior one with a median yellow line; two longitudinal rows of brown or brownish hairs; pleuræ yellow; pectus brownish; scutellum yellow, fringed with brown hairs; metanotum brown. Halteres yellow. Abdomen about twice the length of thorax, pale yellowish-brown, clothed with a yellowish pubescence; lamellæ of ovipositor pale yellowish-brown. Legs brownish-ochreous. Tibial spurs deep brown. In fore legs metatarsus twice length of tibia. Wings nearly length of entire body, pellucid, almost hyaline, with roseous and brassy reflections; very long hairs on posterior margin; veins brownish. Costal and third longitudinal veins meeting very much before apex of wing and opposite tip of anterior branch of fifth longitudinal fork; auxiliary vein most indistinct, apparently joining costa a

short distance beyond middle cross-vein; first longitudinal vein reaching costa opposite middle of anterior branch of fifth longitudinal fork; basal portion of fourth longitudinal, middle cross-vein, and third longitudinal appearing as one perfectly straight distinct vein; fourth longitudinal vein extremely pale beyond middle cross-vein, almost reaching wing-margin, terminating opposite apex, and mid-way between tip of costal and that of anterior branch of fifth longitudinal fork; base of latter lying somewhat beyond middle cross-vein, its posterior branch about ½ the length of anterior.

Hab.—Berowra, Hawkesbury district, N.S.W. (Skuse). August.

Genus 5. Metriocnemus, v.d. Wulp.

Metriocnemus, v.d. Wulp, Tijd. Entom. 1873-74, XVII. p. 136.

Antennæ 2- + 12-jointed in ♂, 2- + 5-jointed in ♀. Thorax not ending in a point anteriorly. Wings haired. Third longitudinal vein terminating at end of anterior margin. Posterior branch of fifth longitudinal fork straight, or only very slightly bent downwards. Feet slender. Tibiæ not broadened. In fore-legs metatarsus shorter than tibia.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance							
		Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
265	*Met. nitidulus* ...	...	...	69	31	...	...	...	...	59	12	20	9

265. METRIOCNEMUS NITIDULUS, sp.n. (Pl. XII., fig. 23).

♀.—Length of antennæ........	0·012 inch	...	0·30 millimètre.
Expanse of wings.........	0·045 × 0·015	...	1·13 × 0·38
Size of body...............	0·060 × 0·013	...	1·54 × 0·32

Antennæ, head and palpi ochreous. Thorax pale ochreous-brown or almost pale fulvous, levigate, with two longitudinal double rows of short yellowish hairs; pleuræ and pectus ochreous or pale brownish-ochreous; scutellum pale ochreous; metanotum greyish-ochreous. Halteres ochreous-yellow. Abdomen about twice the length of thorax, pale faded brown, generally paler between segments, clothed with short yellowish hairs; lamellæ of ovipositor short. Legs slender, ochreous or pale brownish-ochreous. Tibial spurs deep brown. In fore legs tibia ¼ longer than metatarsus. Wings longer than abdomen, sparingly haired, pellucid, almost hyaline with a brassy reflection; veins brownish-yellow. Costal extending beyond tip of third longitudinal more than half way to tip of fourth longitudinal; auxiliary vein very indistinct, reaching costa opposite base of fifth longitudinal fork; first longitudinal vein joining costa much nearer to middle cross-vein than to tip of third longitudinal; second longitudinal very indistinct, reaching costa opposite middle of anterior branch of fifth longitudinal fork; middle cross-vein and fourth longitudinal pale; latter not reaching wing-margin, its tip nearer to tip of costal than to that of anterior branch of fifth longitudinal fork; base of latter lying much beyond middle cross-vein, both branches not reaching margin, posterior one more than ½ the length of anterior.

Hab.—Sydney (Skuse). January.

Section II. TANYPINA.

Head small, transverse above, rounded in front, situated deep in thorax. Eyes large, reniform, separate in both sexes. Ocelli

wanting. Palpi four-jointed, prominent, incurved, sub-cylindrical, first joint shortest, second joint shorter than third, fourth longest. Antennæ porrected, diverging a little sidewards, filiform, seated in a notch in the eyes, 2- + 13-jointed in both sexes, or 2- + 13-jointed in ♂, and 2- + 10-jointed in ♀; first joint of scapus large and globose, second combined with flagellum, small, cupuliform; in ♂ the next following eleven flagellar joints sub-globose, gradually diminishing in size, twelfth flagellar joint longer than all others, all plumose, terminal joint short, elongate-conic, pubescent; in ♀, first three or four flagellar joints sub-globose, remainder gradually becoming more elongate or obovate, all verticillate-pilose, terminal joint equal in length to two of preceding, sub-lanceolate, pubescent. Mouth not prolonged. Thorax ovate, highly arched; scutellum nearly as wide as thorax, lunate: metanotum gibbose. Halteres small. Abdomen long, slender, seven-segmented, with a wide anal joint and hooked forceps, shorter and stouter in ♀. Legs slender, moderately long, pubescent, anterior sometimes the longest; fore legs remote from the others; coxæ moderate; femora rather stout; tibiæ longer, with minute spurs; in ♂ fore tarsi sometimes pilose, in ♀ with a minute pubescence; ungues minute, acute. Wings narrow, elongate, lanceolate, well rounded at base, pubescent or naked, ciliated; deflexed in repose. Costal vein reaching about apex of wing; humeral cross-vein present; auxiliary vein disappearing close to costa, beyond half the length of wing; sub-costal cross-vein wanting; first longitudinal vein bent upwards, joining costa at about two-thirds the length of wing; marginal cross-vein very obliquely situated; second longitudinal bent slightly upwards, joining costa at about $\frac{1}{3}$ the distance from tip of first to that of third longitudinal vein; third longitudinal vein very arcuated towards its tip, much bent downwards, ending a little before apex of wing; fourth longitudinal vein curved a little downwards towards tip, joining margin some distance below apex of wing; fork of fifth longitudinal vein with its base lying at or beyond base of posterior cross-vein; wing-fold running close to fifth longitudinal vein for whole of its length.

Genus 7. TANYPUS, Meig.

Tanypus, Meigen, Illiger's Mag. II. p. 261, 1803; Latreille, Gen. Cr. et Ins. IV. p. 247, 1809; Fries, Mon. Tanyp. Suec. 1823; Macquart, S. à B. I. p. 60, 1834; Curtis, Brit. Ent. XI. p. 501, 1834; Zetterstedt, D.Sc. IX. 1850; Walker, I.B. III. p. 196, 1856; Schiner, F.A. Dipt. 1864.

Antennæ 2- + 13-jointed. Wings pubescent. Marginal cross-vein and second longitudinal vein most distinct. Fork of fifth longitudinal vein with its base at base of posterior cross-vein.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	SPECIES.	RELATIVE LENGTH				RELATIVE DISTANCE							
		Of the metatarsal joint in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsal joint in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
266	*Tan. Mastersi* ...	...	...	67	33	...	...	...	...	70	10	17	3

266. TANYPUS MASTERSI, sp.n. (Pl. XII., fig. 24).

♀.—Length of antennæ...... 0·030 inch ... 0·76 millimètre.
Expanse of wings........ 0·125 × 0·033 ... 3·16 × 0·84
Size of body............... 0·100 × 0·030 ... 2·54 × 0·76

Antennæ brown, with yellow verticils; first joint of scapus castaneous. Head, front, and clypeus castaneous. Palpi sordid ochre-yellow, densely pubescent. Eyes deep green. Thorax dull ochreous-brown, with a few scattered yellow hairs and three moderately broad deep brown longitudinal stripes, all reaching scutellum, intermediate stripe starting about $\frac{1}{3}$ of its length from anterior

margin, lateral ones commencing a little above middle of thorax; pleuræ, pectus, and metanotum castaneous, the latter with an ochreous or ochreous-brown median line; scutellum dull ochreous-brown, fringed with yellow hairs. Halteres sordid ochreous. Abdomen not twice the length of thorax, umbrous-brown, superior segments more or less tinged with castaneous, moderately clothed with yellow hairs. Legs ochre-yellow, coxæ and femora more or less tinged with brown, all joints slightly tipped with brown at apex and densely covered with a yellow pubescence. In fore legs tibia longer (?) than metatarsus. Wings longer than entire body, densely haired, hyaline, slightly tinted with brown in vicinity of cross-veins, veins pale ochreous-yellow; pubescence mostly pale yellow, but somewhat sooty across wing at cross-veins, and again less distinctly at apex of the wing. Costal vein extending beyond tip of third longitudinal vein $\frac{1}{4}$ the distance from that to tip of fourth longitudinal vein; auxiliary vein very indistinct towards tip, scarcely reaching costa, terminating about mid-way between origin of second longitudinal vein and tip of first longitudinal; first, second, and third longitudinal veins running parallel and at equal distances apart; tip of second longitudinal rather more than $\frac{1}{3}$ the distance from tip ot first longitudinal to that of third longitudinal; marginal cross-vein joining first longitudinal very close to tip; middle and posterior cross-veins forming a very obtuse angle; fourth and fifth longitudinal veins very pale and indistinct beyond cross-veins.

Hab.—Lawson, Blue Mountains (Masters). January.

Obs.—The above is drawn from a single specimen not in the best condition, but the species is a well-marked one, and will, I think, be recognised without difficulty.

Genus 8. Isoplastus, gen.nov.

Antennæ in ♂ 2-+13-jointed, in ♀ 2-+10-jointed. Wings pubescent. Marginal cross-vein and second longitudinal vein pale and indistinct. Fork of fifth longitudinal vein with its base at base of posterior cross-vein.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance							
		Of the second tarsal joint in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
267	*Isop. notabilis* ...	65	35	66	34	68	10	15	7	63	12	19	6
268	*Isop. levidensis* ...	66	34	...	...	60	8(?)	24(?)	8	...	...	...	...
269	*Isop. formulosus*...	67	33	67	33	68	8	14	10	67	7	21	5

267. Isoplastus notabilis, sp.n. (Pl. xii., fig. 25).

♂.—Length of antennæ....... 0·050 inch ... 1·27 millimètres.
Expanse of wings......... 0·095 × 0·025 ... 2·39 × 0·62
Size of body.............. 0·140 × 0·025 ... 3·55 × 0·62

♀.—Length of antennæ....... 0·025 inch ... 0·62 millimètre.
Expanse of wings......... 0·095 × 0·030 ... 2·39 × 0·76
Size of body.............. 0·085 × 0·025 ... 2·14 × 0·62

♂ and ♀.—Antennæ of the ♂ whitish or with first joint of scapus black, with whitish or yellowish plumes; of the ♀ entirely yellowish. Head brown or black, with a sparse yellowish pubescence. Clypeus and palpi brown or ochreous-brown, with a dense yellowish pubescence. Thorax brown, opaque, more or less hoary, with three longitudinal, parallel, generally indistinct, brown lines beset with pale yellow hairs, intermediate line terminating at apex of an ovate depression situated in front of scutellum, lateral ones reaching scutellum; pleuræ brown; scutellum brown, or ochreous-brown, fringed with pale yellow hairs; metanotum generally

dark brown. Halteres white. Abdomen in ♂ very slender, three times the length of thorax, whitish, with pale yellow hairs, third to sixth segments more or less distinctly streaked or spotted with brown, sixth and seventh often entirely brown; anal joint and forceps yellowish or whitish; in ♀ nearly the breadth but not twice the length of thorax; uniformly brown, clothed with short pale yellow hairs. Legs whitish or pale yellowish, numerously ringed with brown. In fore legs tibia $\frac{1}{5}$ longer than metatarsus. Wings covered with short white or pale yellow hairs, limpid, with numerous small brownish spots. Costal and third longitudinal veins meeting much before apex of wing; auxiliary vein indistinct, reaching costa about mid-way between middle cross-vein and tip of first longitudinal; first longitudinal vein reaching costa in ♂ mid-way between middle cross-vein and tip of third longitudinal, in ♀ nearer middle cross-vein; marginal cross-vein almost parallel with costa; second longitudinal reaching costa in ♂ at a point $\frac{2}{5}$ the distance from tip of first to that of third longitudinal vein, more than $\frac{2}{5}$ in ♀; fourth and fifth longitudinal veins pale beyond cross-veins; posterior cross-vein situated before middle cross-vein, in ♂ a distance rather greater than its length, in ♀ somewhat less.

Hab.—Nepean River, near Penrith, Blue Mts., and Sydney, N.S.W. (Skuse). October. Not common.

268. Isoplastus levidensis, sp.n.

♂.—Length of antennæ......	0·040 inch	...	1·01 millimètres.
Expanse of wings........	0·080 × 0·020	...	2·02 × 0.50
Size of body..............	0·110 × 0·020	...	2·79 × 0·50

Antennæ yellowish-grey; first joint of scapus light brown. Head, front and clypeus light brown. Palpi somewhat sordid ochreous. Thorax light ochreous-brown, opaque, somewhat pruinose, with three longitudinal, parallel rows of yellow hairs, lateral ones along a distinct pruinose line, beginning just below humeri; pleuræ, pectus, scutellum and metanotum light brown. Halteres

pallid. Abdomen nearly three times the length of thorax, very pale ochreous-yellow, each segment with a broad ill-defined band of brown, clothed with yellow hairs; anal joint very pale ochreous-yellow, forceps brown. Legs very pale ochreous-yellow, densely covered with pale hairs. In fore legs tibia a little longer than metatarsus. Wings about the length of abdomen, pellucid, almost hyaline, densely haired, veins pale ochreous-yellow. Costal meeting third longitudinal vein much before apex of wing; latter vein running parallel with first longitudinal; auxiliary vein terminating about mid-way between origin of third and tip of first longitudinal vein; second longitudinal and marginal cross-vein extremely indistinct,* close to first longitudinal; middle and posterior cross-veins equal in length, latter situated somewhat before former; fourth and fifth longitudinal veins pale and indistinct past cross-veins.

Hab.—Wheeny Creek, Hawkesbury District, N.S.W. (Skuse). January.

Obs.—I have seen only a single specimen.

269. Isoplastus formulosus, sp.n. (Pl. xii., fig. 26).

♂.—Length of antennæ.......	0·040 inch	...	1·01 millimètres.
Expanse of wings.........	0·080 × 0·020	...	2·02 × 0·50
Size of body..............	0·100 × 0·017	...	2·54 × 0·42
♀.—Length of antennæ.......	0·030 inch	...	0·76 millimètre.
Expanse of wings.........	0·080 × 0·025	...	2·02 × 0·62
Size of body..............	0·060 × 0·017	...	1·54 × 0·42

♂ and ♀.—Antennæ pale ochre-yellow, with pale yellow verticils. Head, clypeus and palpi brown or ochreous-brown, with yellow hairs. Thorax ochreous or light umber-brown, dull, traversed for its whole length by three longitudinal, parallel rows of rather long yellow hairs; pleuræ and pectus brown; scutellum ochreous or ochreous-brown, fringed with pale yellow hairs;

* In this and the following species these two veins are so indistinct that they might be regarded as absent, and what are taken to be indications of them may result from wing-folds or even from the pubescence of the wing.

metanotum brown. Halteres pale yellow or whitish. Abdomen in ♂ three times the length of thorax, yellow or whitish, each segment banded anteriorly with brown and covered with long pale yellow hairs; anal joint and forceps generally ochreous-yellow; in ♀ not twice the length of abdomen, brown, rather densely covered with pale yellow hairs. Legs pale ochre-yellow, densely haired. In fore legs tibia $\frac{1}{8}$ longer than metatarsus. Wings in ♂ as long as, or a little longer than, abdomen, in ♀ a little longer than the whole body, pellucid, almost hyaline, densely haired, with yellowish veins; pubescence pale, with six small more or less indistinct brownish patches;* three equidistant ones on anterior border, last (just before tip of second longitudinal vein) squarish and most distinct of all; three indistinct ones on posterior border, one at tip of each branch of fifth longitudinal fork, and third mid-way between tip of posterior branch and anal angle. Costal vein extending a little beyond tip of third longitudinal vein, but terminating far from apex of wing; auxiliary vein very indistinct, apparently terminating near costa a short distance beyond middle cross-vein; first longitudinal vein reaching costa in ♂ somewhat beyond, in ♀ at a point mid-way between middle cross-vein and tip of costa; marginal cross-vein and second longitudinal vein exceedingly indistinct, latter reaching costa at a point about $\frac{1}{3}$ (?) the distance from tip of first longitudinal vein to that of third longitudinal; posterior cross-vein situated before middle cross-vein a distance equal to its length; fourth and fifth longitudinal veins very pale and indistinct.

Hab.—Berowra (Masters and Skuse).

Genus 9. Procladius, gen.nov.

Antennæ in ♂ 2- + 13-jointed. Wings naked. Marginal cross-vein and second longitudinal vein distinct. Fork of fifth longitudinal vein short, its base lying mid-way between posterior cross-vein and tip of its posterior branch.

* More distinct when the wing is viewed at a certain obliquity.

INDICES OF ALAR AND TARSAL PROPORTIONS.

No.	Species.	Relative Length				Relative Distance							
		Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to D.	From D to E.	From A to B.	From B to C.	From C to D.	From D to E.
		♂	♂	♀	♀	♂	♂	♂	♂	♀	♀	♀	♀
270	*Proc. paludicola*...	64	36	...	...	67	12	15	6	...	...	...	...
271	*Proc. pictipennis*...	?	?	...	...	62	13	19	6	...	...	...	...

270. Procladius paludicola, sp.n. (Pl. xii., fig. 27).

♂.—Length of antennæ...... 0·040 inch ... 1·01 millimètres.
Expanse of wings........ 0·080 × 0·020 ... 2·02 × 0·50
Size of body............... 0·125 × 0·020 ... 2·79 × 0·50

Antennæ mouse-coloured, large basal joint black. Head black, more or less tinged with ochreous; clypeus and palpi brown or ochreous-brown, with yellow hairs. Thorax black, opaque, more or less hoary in a certain light, with an ochreous spot at the humeri; traversed from anterior border to scutellum by three longitudinal and parallel rows of short yellow hairs; pleuræ, pectus, scutellum, and metanotum black. Halteres white. Abdomen about 2½ times length of thorax, brownish-black, posterior border of each segment lighter, rather densely clothed with yellow hairs; anal joint and forceps wider than preceding segment, brownish-black. Coxæ and femora deep brown or black. Tibiæ and metatarsi ochreous, former distinctly ringed with deep brown or black at apex; four remaining joints of tarsi pitch-brown, In fore legs tibia ⅓ longer than metatarsus. Wings about length of

abdomen, pellucid, almost hyaline, with a few minute hairs about tip; veins brown. Costal vein extending beyond tip of third longitudinal about $\frac{1}{3}$ the distance from that to tip of fourth longitudinal vein; auxiliary vein directed towards costa, disappearing somewhat beyond the middle of wing; second longitudinal vein bent upwards, pale, running very close to third longitudinal as far as marginal cross-vein; third longitudinal vein straight, bent slightly downwards towards tip; middle cross-vein very thick, in line with posterior cross-vein; latter slender; fourth longitudinal vein very pale for whole of its length.

Hab.—Hexham Swamps, near Newcastle, N.S.W. (Skuse). April.

271. PROCLADIUS PICTIPENNIS, sp.n. (Pl. XII., fig. 28).

♂.—Length of antennæ......	— inch	...	— millimètre.
Expanse of wings........	$0{\cdot}055 \times 0{\cdot}017$	...	$1{\cdot}39 \times 0{\cdot}42$
Size of body................	$0{\cdot}070 \times 0{\cdot}017$	...	$1{\cdot}77 \times 0{\cdot}42$

Antennæ brownish (portion lost); first joint of the scapus black. Head very pale ochreous or whitish. Clypeus and palpi pale brownish. Thorax dark brown or black, pruinose, with a very pale ochreous or whitish spot at humeri; three longitudinal and parallel rows of very short yellow hairs; pleuræ and pectus dark brown, the former with a patch of very pale ochreous or whitish; scutellum testaceous-brown; metanotum dark brown or black. Halteres white, stem yellowish. Abdomen about $2\frac{1}{2}$ times the length of thorax, brown, lighter between segments, rather sparingly clothed with brownish-yellow hairs; anal joint and forceps wider than preceding segment, dark brown, posterior border whitish. Coxæ brown; trochanters ochre-yellow. Femora brown, ochre-yellow at extreme base. Fore tibiæ yellowish-brown, intermediate and hind tibiæ whitish, all dark brown at base and apex. Tarsi (two hind pairs lost) yellowish-brown, end joints darker. In fore legs tibiæ $\frac{1}{3}$ longer than metatarsus. Wings length of abdomen, pellucid, almost hyaline, with three indistinct

brownish markings; darkest spot enveloping middle cross-vein; a pale one on posterior margin opposite to last; and a pale fascia starting from anterior margin, filling space between tips of first and second longitudinal veins, and scarcely reaching as far as anterior branch of fifth longitudinal. Veins yellowish-brown. Auxiliary vein directed towards costa, disappearing opposite base of fork of fifth longitudinal; costal vein extending beyond tip of third longitudinal $\frac{1}{4}$ the distance from that to tip of fourth longitudinal; second longitudinal bent upwards, pale, running very close to third longitudinal as far as marginal cross-vein; third longitudinal bent a little downwards towards tip; middle cross-vein thick, somewhat indistinct, situated a little in advance of posterior cross-vein; latter slender; fourth longitudinal very pale.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). January.

Obs.—Very like the last, but distinguished from it particularly by the wing-markings and pale patch on the pleuræ.

Section III. CERATOPOGONINA.

Head small, generally depressed in front, prolonged into a very short rostrum. Eyes lunate, almost reniform. Ocelli wanting. Proboscis more or less porrect. Labrum seated on the upper base of labium, horny, pointed, flat, about the length of labium, sometimes only two-thirds its length. Mandibles seated on the under base of labium, horny, sub-falcate, acuminate, toothed, usually the length of labrum. Palpi originating on both sides of base of labium, 4-jointed; first joint cylindrical, second generally longer, cylindrical, conical, oval, clavate or orbicular; third and fourth cylindrical or oval, shorter than second, the fourth longer than second, or both longer. Antennæ porrect, filiform, with a varying number of joints, usually 2- + 12-jointed, longer than the head, sometimes almost the length of entire body; first joint of scapus large, globose or disciform; second joint of scapus and first seven flagellar joints globose, or ovate to oblong-ovate, sessile

or pedicelled; eighth to twelfth flagellar joints generally more or less elongate, oval, elliptical or cylindrical, beset with short hairs, and at base verticillate-pilose; in ♂ second joint of scapus and following seven flagellar joints usually bearing a thick brush or plume of hairs. Thorax arched, almost oval, flattened in front of scutellum; scutellum small, semicircular; metathorax very short. Halteres short, naked. Abdomen with eight segments, cylindrical or flattened, sometimes narrowing at base; in ♂ terminating in a short forceps. Legs of about equal length, approximate at the base; femora sometimes incrassated, sometimes spinulose beneath; tibiæ sometimes incrassated; tarsal joints varying in length; ungues variable. Wings usually lanceolate or oval, haired or naked in both sexes, sometimes naked or partly haired in ♂ and entirely or partly haired in ♀; incumbent in repose. Seven longitudinal veins. Third longitudinal when present usually extremely rudimentary and indistinct; third and fourth usually forked, fifth always forked. Marginal and middle cross-veins normally present. Auxiliary vein usually pale and indistinct. Costal terminating before, at, or beyond the middle of the anterior border, not reaching the apex of the wing. First longitudinal vein joining before the end of costa, distinct. Second longitudinal usually originating from first longitudinal beyond its middle (in *Leptoconops* from base of wing), distinct, usually united to first longitudinal by marginal cross-vein. Third longitudinal vein generally very indistinct, often entirely absent, usually appearing as a faint detached fork (in *Leptoconops* simple, arising from base of wing). Fourth longitudinal originating from fifth longitudinal not far from base, pale, very pale at its origin, with rare exceptions joined to base (or a little beyond it) of second longitudinal by middle cross-vein, anterior branch reaching margin above, at, or below apex of wing, posterior branch originating somewhat before, at, or a little beyond the middle cross-vein, sometimes detached, rarely entirely wanting. Fifth longitudinal with a short or moderate fork, pale, its posterior branch reaching margin before, opposite, or beyond end of second longitudinal.

Genus 10. Leptoconops, gen.nov.

Antennæ in ♀ 2-+11-jointed; first joint of scapus large, disciform; second smaller, globose; flagellar joints globose, gradually diminishing in size, more ovate towards apex, terminal joint elongate-ovate. Proboscis prominent. Palpi 4-jointed; first and second joints small, third greatly incrassated, about three times the length of first or second; fourth not as long as last, slender, cylindrical. Wings naked. All longitudinal veins taking their origin at the base of the wing. Marginal cross-vein present. Middle cross-vein wanting. Fourth and fifth longitudinal veins only forked.

272. Leptoconops stygius, sp.n. (Pl. xiii., fig. 29).

♀.—Length of antennæ........	0·017 inch	...	0·42 millimètre.
Expanse of wings	0·050 × 0·020	...	1·27 × 0·50
Size of body................	0·065 × 0·017	...	1·66 × 0·42

Entirely black. Joints of the antennæ with dense light greyish verticils. Head and thorax levigate, with minute black hairs. Abdomen about twice the length of thorax, opaque, with some minute black hairs; lamellæ very long, slender. Legs slender. Hind metatarsus ⅓ longer than second tarsal joint. In fore legs tibia rather more than twice the length of metatarsus. Wings hyaline, rather weakly iridescent; costal and first two longitudinal veins greyish-brownish, the rest pale and indistinct. Auxiliary vein not distinguishable, apparently wanting; first and second longitudinal veins reaching costa before middle of anterior border, confluent at tips, tip of second longitudinal almost opposite, but immediately beyond tip of posterior branch of fifth longitudinal vein; marginal cross-vein indistinct; marginal cell small; third longitudinal vein arcuated, not quite reaching the margin, terminating a little above the apex of the wing; fourth longitudinal bellied downwards at middle, reaching margin a little below apex of wing, the posterior branch detached; fork of fifth longitudinal wide, the anterior branch twice the length of the posterior.

Hab.—Woronora (Skuse). October.

Genus 11. Ceratopogon, Meig.

Ceratopogon, Meig., Ill. Mag. II. p. 261, 1803; Syst. Beschr. I. p. 68, 1818; Latreille, Crust. et Ins. IV. p. 250, 1809; Curtis, Brit. Ent. VI. p. 285, 1829; Macquart, S. à B. I. p. 63, 1834; Zetterstedt, D.Sc.; Winnertz, Linn. Entom. VI. p. 3, 1852; Walker, Ins. Brit. Dipt. III. p. 205, 1856.

Antennæ 2-+12-jointed, second joint of scapus and seven following flagellar joints small, globose or ovate, adorned in ♂ with long hairs forming a thick brush or plume, last five joints ovate, elongate or cylindrical. Proboscis more or less prominent. Palpi 4-jointed; first joint small, second usually longer, cylindrical, conical or oval, third and fourth joints cylindrical or ovate, shorter or longer than second joint. Wings hairy or naked. Marginal cross-vein present or wanting. Third longitudinal wanting or extremely rudimentary, indistinct. Fourth and fifth longitudinal veins forked, the fork of the latter short.

Winnertz's distribution of the species tabulated in his monograph of *Ceratopogon* is substantially set forth in the following translation; the venation and cells in the wings being, however, subject to an entirely different interpretation and nomenclature:—

FIRST DIVISION.

Marginal Cross-vein Present.

A. Wings wholly or partially hairy, those of males of some species entirely naked. All femora simple, unarmed.

a. Ungues with hairy pulvilli. Ungues of equal length in both sexes.

1. In hind feet metatarsus shorter than second tarsal joint, or both of equal length. *Forcipomyia*, Meg.; *Labidomyia*, Steph.

Second longitudinal vein joining costa:

* In middle of anterior border, or before it.

** Between middle of anterior border and apex of wing.

2. In hind feet metatarsus longer than second tarsal joint.

Second longitudinal vein joining costa :

* In middle of anterior border, or before it.

** Between middle of anterior border and apex of wing.

b. Ungues with bristly hairs instead of pulvilli. Ungues of equal length in both sexes.

In hind feet metatarsus longer than second tarsal joint.

Second longitudinal vein joining costa :

* In middle of anterior border, or before it.

** Between middle of anterior border and apex of wing. *Culicoides*, Latr.

c. Ungues without pulvilli or bristly hairs. One of the ungues longer than the other (in ♀ only ?).

In hind feet metatarsus longer than second tarsal joint.

Second longitudinal vein joining costa between middle of anterior border and apex of wing.

B. Wings entirely naked. Second longitudinal vein joining costa between middle of anterior border and apex of wing.

a. All femora unarmed.

1. Ungues not denticulated.

* Ungues of equal length in both sexes.

** Ungues equally long, with a side-claw standing outwards in ♀.

*** In ♀ one claw longer than the other.

2. Ungues (in the ♀ only ?) with a tooth on inner side. Ungues of equal length.

b. Some or all the femora spinose beneath. *Palpomyia*, Meg.

1. Ungues not denticulated.

α. Ungues of equal length in both sexes.

* Plantæ hairy.

** Plantæ spinulose.

β. One of the ungues longer than the other in ♀. Plantæ hairy.

2. Ungues (in ♀ only?) with a tooth on inner side.

α. Ungues of equal length in both sexes.

* Plantæ hairy.

** Plantæ spinulose. *Sphæromias*, Steph.; Curt.

c. Hind femora incrassated, spinose beneath.

Ungues not denticulated.

One of the ungues longer than the other in ♀. *Serromyia*, Meg.; *Prionomyia*, Steph.

SECOND DIVISION.

Marginal Cross-vein Wanting.

Wings naked. Second longitudinal vein joining costa between middle of anterior border and apex of wing.

A. All the femora unarmed.

1. Ungues not denticulated.
2. Ungues with a tooth on inner side.
3. Ungues with a side-claw standing outwards. Plantæ spinulose.

B. Some or all femora spinose beneath.

1. Ungues not denticulated.
2. Ungues with a tooth on inner side in ♀.

INDICES OF ANTENNAL, ALAR, AND TARSAL POPORTIONS.

No.	Species.	Relative Length				Relative Distance						Relative Length	
		Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	Of the metatarsus in the hind feet.	Of the second tarsal joint in the hind feet.	From A to B.	From B to C.	From C to E.	From A to B.	From B to C.	From C to E,	Of the second joint of scapus and first seven joints of flagellum.	Of the five last joints of the antennæ.
		♂	♂	♀	♀	♂	♂	♂	♀	♀	♀	♀	♀
273	*C. albopunctatus* ...	48	52	50	50	44	4	52	42	5	53	60	40
274	*C. æqualis*	50	50	...	...	43	6	51	...	...	...	...	...
275	*C. saltivagus* ..	...	...	67	33	...	...	...	40	8	52	53	47
276	*C. rhynchops* ...	...	...	72	28	...	...	...	54	24	22	29	71
277	*C. Mastersi*	74	26	75	25	53	16	31	52	24	24	33	67
278	*C. insignis*	...	...	69	31	...	...	...	41	14	45	40	60
279	*C. subnitidus* ...	...	...	67	33	...	...	...	39	10	51	63	37
280	*C. minusculus* ...	66	34	...	...	40	3	57	...	...	...	...	...
281	*C. nigellus*	...	...	69	31	...	...	..	44	6	50	52	48
282	*C. decempunctatus*	...	...	68	32	...	...	...	44	12	44	44	56
283	*C. Sydneyensis* ...	70	30	70	30	47	6	47	43	14	43	48	52
284	*C. æratipennis* ...	72	28	71	29	40	12	48	47	6	47	53	47
285	*C. marmoratus* ...	...	...	70	30	...	...	...	60	6	34	45	55
286	*C. molestus*	...	...	69	31	...	...	...	59	11	30	53	47
287	*C. tigrinus*	...	...	66	34	...	...	...	55	18	27	47	53
288	*C. imperfectus* ...	...	...	66	34	...	...	...	50	25	25	?	?
289	*C. latipennis* ...	...	...	75	25	...	...	...	47	11	42	50	50

I. Marginal Cross-vein Present.

A. *Wings wholly or partly haired, those of ♂ in some species entirely naked. All femora simple, unarmed.*

a. Ungues with hairy pulvilli, of equal length in both sexes.

1. In hind feet metatarsus shorter than, or equal in length to, second tarsal joint.

* *Second longitudinal vein joining costa at or before middle of anterior border.*

273. Ceratopogon albopunctatus, sp.n. (Pl. xiii., fig. 30).

♂.—Length of antennæ........	0.025 inch	...	0.62 millimètre.
Expanse of wings.........	0·047 × 0·015	...	1·18 × 0·38
Size of body................	0·065 × 0·018	...	1·66 × 0·45
♀.—Length of antennæ.........	0·023 inch	...	0·58 millimètre
Expanse of wings..........	0·050 × 0·022	..	1·27 × 0·55
Size of body................	0·060 × 0·020	...	1·54 × 0·50

♂ and ♀.—Antennæ yellowish-brown, plumes with golden reflections. Head brown, with whitish or pale yellowish pubescence. Palpi brownish. Thorax brown, with whitish or pale yellowish pubescence, pleuræ and pectus brown, slightly yellow below origin of wings; scutellum and metanotum brown. Halteres white with ochreous stem. Abdomen about three times the length of thorax, brown, paler between segments, clothed with brownish hairs; anal joint and forceps brown. Legs brownish-ochreous or pale brownish. In fore legs tibia about three times length of metatarsus. Wings about the length of abdomen, hyaline, covered with yellowish hairs, more brownish along anterior margin, with a marginal white spot at tip of second longitudinal; veins brownish. Auxiliary vein indistinct towards its tip, terminating close to tip of first longitudinal; first and second longitudinal veins in ♂ both reaching costa before base of fifth longitudinal fork, in ♀ second longitudinal reaching costa opposite or somewhat beyond; inner marginal cell obliterated by confluence of veins; trace of third longitudinal present; fork of fourth longitudinal very pale with a short petiole, branches slightly divergent, the tip of anterior one somewhat nearer apex of wing than that of posterior; anterior branch of fifth longitudinal fork little arcuated.

Hab.—Sydney, Wheeney Creek, and Knapsack Gully, Blue Mountains, N.S.W. (Masters and Skuse), Common in December and January.

274. Ceratopogon æqualis, sp.n. (Pl. xiii., fig. 31).

♂.—Length of antennæ......	0·035 inch	...	0·88 millimètre.
Expanse of wings........	0·060 × 0·017	...	1·54 × 0·42
Size of body..............	0·085 × 0·020	...	2·14 × 0·50

Antennæ brown, plumes with a pale reflection. Head black. Palpi ochreous-brown or fulvous. Thorax black or deep brown, opaque, covered with pale yellow or whitish hairs; pleuræ and pectus deep brown or black; scutellum brown or brownish-black; metanotum black. Halteres whitish, yellowish or pale ochreous. Abdomen about twice the length of thorax, deep brown, almost black, densely clothed with long brownish-yellow hairs. Legs ochreous-yellow, minutely darker at articulations. In fore legs tibia rather more than twice the length of metatarsus. Wings longer than abdomen, hyaline, densely covered with pale yellow hairs, with a more or less brassy reflection. Costal and first two longitudinal veins brownish. Auxiliary vein indistinct, apparently terminating in costa immediately before tip of first longitudinal; first and second longitudinal veins terminating near one another, reaching costa before base of fifth longitudinal fork; inner marginal cell obliterated by confluence of veins; very indistinct trace of fork of third longitudinal present; middle cross-vein and fourth longitudinal very pale, fork of latter with a short petiole, branches slight divergent, tip of anterior one reaching margin at a point nearer apex of wing than that of posterior branch; anterior branch of fifth longitudinal fork nearly straight, twice the length of posterior branch.

Hab.—Hexham Swamps, near Newcastle, N.S.W. (Skuse). April.

2. In hind feet metatarsus longer than second tarsal joint.

* *Second longitudinal vein joining costa at or before middle of anterior border.*

275. Ceratopogon saltivagus, sp.n. (Pl. xiii., fig. 32).

♀.—Length of antennæ.........	0·017 inch	...	0·42 millimètre.
Expanse of wings..........	$0{\cdot}040 \times 0{\cdot}016$	...	$1{\cdot}01 \times 0{\cdot}40$
Size of body................	$0{\cdot}040 \times 0{\cdot}015$	...	$1{\cdot}01 \times 0{\cdot}38$

Brown. Head, thorax and abdomen with pale yellow hair; latter about once and a half the length and rather narrower than thorax. Legs brownish-ochreous. In fore legs tibia twice the length of metatarsus. Wings the length of entire body, hyaline, richly iridescent, densely pubescent; costal and first two longitudinal veins yellowish; rest pale. Auxiliary vein very pale and indistinct; first and second longitudinal veins both reaching costa before middle of wing, tip of second longitudinal opposite base of fifth longitudinal fork; inner marginal cell obliterated by confluence of veins; extremely indistinct trace of rudimentary third longitudinal fork; fourth longitudinal fork with a short petiole, branches moderately divergent, anterior one joining margin a little above apex of wing, posterior one detached at its base, almost straight, its tip scarcely nearer to tip of anterior branch of fifth longitudinal fork than to that of anterior branch; both branches of fifth longitudinal nearly straight, anterior one not twice the length of posterior.

Hab.—Berowra, N.S.W. (Skuse).

** *Second longitudinal vein joining costa beyond middle of anterior border.*

276. Ceratopogon rhynchops, Schiner (Pl. xiii., fig. 33).

C. rhynchops, Sch., Diptera der Novara Expedition, Zool. Theil, Bd. II. p. 26, 1868.

♀.—Length of antennæ......	0·047 inch	...	1·18 millimètres.
Expanse of wings........	$0{\cdot}070 \times 0{\cdot}025$	...	$1{\cdot}77 \times 0{\cdot}62$
Size of body..............	$0{\cdot}070 \times 0{\cdot}020$	...	$1{\cdot}77 \times 0{\cdot}50$

Bright rust-yellow; thorax nitidous. Abdomen dull, apex clubbed and rather densely haired. Head yellow. Eyes black, contiguous in front. Antennæ bright yellow at base, flagellar joints brownish. Proboscis almost the length of head. Palpi yellow. Legs uniformly pale yellow, tarsi scarcely darker towards their extremity. Wings almost hyaline, distinctly haired; veins exactly as with *Ceratopogon rostratus*, Wtz. (Linn. Entom. VI. p. 31, taf. IV. fig. 23b). $1\frac{1}{4}^{m}$.

Hab.—Sydney (Frauenfeld). Three specimens of ♀.

Obs.—I have a large series of specimens (strange to say all are of the ♀) of a species which is generally distributed in N.S.W., and which I take to be *C. rhynchops*, Sch. None, however, quite agree in the colouring mentioned in Schiner's description translated above; there appear to be four varieties amongst the specimens before me.

Var. β. Head black. Thorax, pleuræ, pectus, scutellum, and metanotum brown, sub-levigate. Abdomen brown, darker than thorax.

Hab.—Sydney, &c. (Masters and Skuse). Several specimens.

Var. γ. Head, thorax, pleuræ, pectus, scutellum, and metanotum black, sub-nitidous. Abdomen brown, also sub-nitidous.

Hab.—Sydney (Masters). One specimen.

Var. δ. Antennæ entirely dusky brown. Head, thorax, pleuræ, pectus, and metanotum black, levigate. Scutellum ochreous or ochreous-brown. Abdomen brown.

Hab.—Glenbrook, Blue Mountains (Masters). Several specimens.

Var. ε. Antennæ entirely dusky brown. Head, thorax, pectus, scutellum, and metanotum black, levigate or sub-nitidous. Abdomen deep brown.

Hab.—Berowra, Como, &c., N.S.W. (Masters and Skuse). Several specimens.

277. CERATOPOGON MASTERSI, sp.n. (Pl. XIII., fig. 34).

♂.—Length of antennæ........	0·035 inch	...	0·88 millimètre.
Expanse of wings..........	$0·065 \times 0·018$	...	$1·66 \times 0·45$
Size of body................	$0·070 \times 0·021$	...	$1·77 \times 0·52$
♀.—Length of antennæ.........	0·027 inch	...	0·68 millimètre.
Expanse of wings..........	$0·065 \times 0·025$	...	$1·66 \times 0·62$
Size of body................	$0·070 \times 0·022$	...	$1·77 \times 0·55$

♂ and ♀.—Antennæ entirely black; ♂ plumes with a cupreous, reflection. Head, thorax, pleuræ, pectus and metanotum black or very deep brown, levigate; thorax with a sparse, short, yellowish pubescence; scutellum brown, fringed with long yellowish-brown hairs. Halteres yellowish or white, the stem more or less discoloured. Abdomen black, or very deep brown, rather dull, clothed with brownish hairs; in ♂ twice the length of thorax, with short, thick holding-forceps; in ♀ short and robust, lamellæ of ovipositor ochreous. Legs ochreous-brown with yellow or brownish-yellow hairs. In fore legs tibia $\frac{1}{3}$ longer than metatarsus. Wings about the length of entire body, pellucid, almost hyaline, with a faint brownish tint on anterior half, brilliantly iridescent, pubescent only about tip in ♂; veins brown; costal, first two longitudinal veins, middle cross-vein and basal half of fourth longitudinal very distinct. Auxiliary vein indistinct, terminating in costa a little before tip of first longitudinal vein; first longitudinal reaching costa at a point $\frac{1}{3}$ (rather more in ♂) distance from base of second longitudinal to tip of costa, and opposite tip of posterior branch of fifth longitudinal fork; marginal cross-vein very short; inner marginal cell very narrow; second longitudinal reaching tip of costa, in ♂ somewhat before, in ♀ opposite, tip of anterior branch of fifth longitudinal fork; indistinct fork of third longitudinal present; fork of fourth longitudinal pale, with a short petiole, anterior branch reaching margin, in ♂ at, in ♀ a little below apex of wing, posterior branch detached at its base, reaching wing-margin mid-way between tips of anterior branch and the

anterior branch of fifth longitudinal fork; the latter arcuated at its tip, posterior branch in ♂ slightly arcuated, in ♀ straight, about ½ the length of anterior.

Hab.—Knapsack Gully, Blue Mountains, N.S.W. (Masters and Skuse).

278. CERATOPOGON INSIGNIS, sp.n. (Pl. XIII., fig. 35).

♀.—Length of antennæ.........	0·017 inch	...	0·42 millimètre.
Expanse of wings..........	0·037 × 0·015	...	0·92 × 0·38
Size of body.................	0·035 × 0·011	...	0·88 × 0·27

Black; antennæ brown, and legs light umber-brown. Head and thorax dull, with a brown pubescence. Halteres white. Abdomen short, robust, dull, rather densely covered with a brown pubescence. In fore legs tibia rather more than twice the length of metatarsus. Wings longer than the entire body, hyaline, densely covered with brownish-yellow pubescence, iridescent; costal and first two longitudinal veins yellowish-brown. Auxiliary vein not distinguishable; first longitudinal gradually running into costa somewhat before base of fifth longitudinal fork, and at a point about mid-way between base of second longitudinal vein and tip of costa; second longitudinal reaching costa a little beyond middle of anterior border, and opposite tip of posterior branch of fifth longitudinal fork; inner marginal cell extremely narrow, veins almost confluent; fork of fourth longitudinal with a short petiole, anterior branch reaching margin at apex of wing, posterior one detached at its base, almost straight, joining about mid-way between tips of anterior branches of fourth and fifth forks; anterior branch of latter not quite twice the length of posterior, not quite reaching margin, slightly arcuated, posterior branch straight.

Hab.—Narrabeen Lagoon, near Manly, N.S.W. (Skuse).

b. Ungues with bristly hair instead of pulvilli.

1. In hind feet metatarsus longer than second tarsal joint.

* *Second longitudinal vein joining costa at or before middle of anterior border.*

279. CERATOPOGON SUBNITIDUS, sp.n. (Pl. XIII., fig. 36).

♀.—Length of antennæ......	0·015 inch ...	0·38 millimètre.
Expanse of wings........	0·042 × 0·017 ...	1·06 × 0·42
Size of body..............	0·050 × 0·015 ...	1·27 × 0·38

Black, sub-nitidous; pleuræ very deep brown; legs brown, tarsi yellowish. Thorax with brownish hairs. Halteres brown or brownish. Abdomen short, robust, clothed with brown hairs; lamellæ of ovipositor black. In fore legs tibia nearly twice the length of metatarsus. Wings about length of entire body, hyaline, with a rich brassy reflection, densely covered with a brownish pubescence; costal, first two longitudinal veins, middle cross-vein, and basal portion of fourth longitudinal brownish. Auxiliary vein indistinguishable; first longitudinal vein joining costa at a point somewhat more than mid-way between origin of second longitudinal vein and tip of costa; second longitudinal reaching costa immediately before middle of anterior margin, and opposite base of fifth longitudinal fork; inner marginal cell narrow; very indistinct trace of third longitudinal fork; fork of fourth longitudinal pale, with a short petiole, anterior branch nearly straight, reaching margin at apex of wing; posterior branch reaching margin at a point somewhat nearer tip of anterior branch of fifth longitudinal fork; both branches of latter nearly straight, anterior scarcely twice the length of posterior.

Hab.—Berowra, N.S.W. (Masters).

280. CERATOPOGON MINUSCULUS, sp.n. (Pl. XIII., fig. 37).

♂.—Length of antennæ.........	0·015 inch ...	0·38 millimètre.
Expanse of wings..........	0·035 × 0·011 ...	0·88 × 0·27
Size of body................	0·035 × 0·010 ...	0·88 × 0·25

Black, opaque; scutellum and club of halteres ochreous-yellow; legs cinereous. Thorax glabrous. Abdomen about ⅓ longer than thorax, somewhat brownish-black, apparently glabrous. In

fore legs tibia about twice the length of metatarsus. Wings the length of entire body, hyaline, with a pale, almost silvery, reflection, very sparingly pubescent near anterior border and apex, and a longitudinal line of extremely short hairs running mid-way between principal veins and along courses of branches of rudimentary third longitudinal fork; costal, first two longitudinal veins, middle cross-vein and basal portion of fourth longitudinal pale brownish. Auxiliary vein indistinct; first and second longitudinal veins reaching costa considerably before middle of wing, and before base of fifth longitudinal fork; both marginal cells obliterated by confluence of veins; fork of fourth longitudinal very pale, invisible at base, the anterior branch straight, joining margin immediately above apex of wing, posterior branch bent a little posteriorly at its tip; fifth longitudinal fork rather short, anterior branch about twice the length of posterior.

Hab.—Sydney (Skuse). December.

281. CERATOPOGON NIGELLUS, sp.n. (Pl. XIII., fig. 38).

♀.—Length of antennæ......	0·017 inch	...	0·42 millimètre.
Expanse of wings........	0·037 × 0·015	...	0·92 × 0·38
Size of body..............	0·040 × 0·010	...	1·01 × 0·25

Black, opaque; scutellum ochreous-yellow, and generally a very small spot of same colour or paler at humeri. Halteres white, base of club and stem dusky brown or black. Abdomen not quite twice length of thorax, brownish-black, sparingly clothed with yellowish hairs. Tibiæ and tarsi more or less yellowish-brown. In fore legs tibia nearly thrice the length of metatarsus. Wings nearly length of entire body, pellucid, almost hyaline, with a delicate brownish tint and brassy roseous reflections; costal, first two longitudinal veins, middle cross-vein, and basal portion of fourth longitudinal yellowish-brown. Auxiliary vein pale and indistinct; first longitudinal vein reaching costa almost opposite but immediately before base of fifth longitudinal fork; second joining a little beyond, at a point in middle of anterior border;

inner marginal cell obliterated by confluence of the veins; marginal cell almost obliterated; indistinct trace of third longitudinal fork, posterior branch close and almost parallel to anterior branch of fourth longitudinal; latter fork very pale, apparently sessile, the posterior branch detached at its base, branches straight at tip, anterior joining immediately above apex of wing, posterior scarcely reaching margin; anterior branch of fifth longitudinal fork scarcely twice the length of posterior.

Hab.—Berowra, N.S.W. (Masters). Two specimens.

** *Second longitudinal vein joining costa beyond middle of anterior border.*

282. CERATOPOGON 10-PUNCTATUS, sp.n. (Pl. XIII., fig. 39).

♀.—Length of antennæ.........	0·021 inch	...	0·52 millimètre.
Expanse of wings..........	0·055 × 0·021	...	1·39 × 0·52
Size of body................	0·065 × 0·020	...	1·66 × 0·50

Black, opaque; scutellum brown; legs deep brown; tarsi yellowish-brown. Thorax with three longitudinal double rows of brown or blackish hairs, divergent posteriorly. Halteres whitish at apex of club. Abdomen short, robust, clothed with brown hairs, second to sixth segments with a small whitish spot on each side, those on fifth very small. In fore legs tibia $\frac{1}{3}$ longer than the metatarsus. Wings shorter than entire body, hyaline, rather densely covered with brownish hairs, with rich cupreous (and somewhat violaceous) reflections; costal, first two longitudinal veins, middle cross-vein and basal portion of fourth longitudinal brown or brownish. Auxiliary vein pale and indistinct; first longitudinal reaching costa almost opposite but immediately before base of fifth longitudinal fork; second longitudinal incrassated, reaching costa somewhat beyond middle of anterior border, and opposite tip of posterior branch of fifth longitudinal fork; inner marginal cell obliterated by confluence of veins; marginal cell almost closed extremely narrow; complete fork, and portion of petiole of third

longitudinal present, pale but distinct, its posterior branch terminating at tip of anterior branch of fourth longitudinal fork; latter pale, indistinct at the base, anterior branch straight, joining immediately above apex of wing; posterior branch arcuating posteriorly, joining wing-margin about mid-way between tips of two anterior branches; distinct wing-fold close and anterior to fifth longitudinal and its anterior branch; posterior branch, of fifth longitudinal fork straight, anterior arcuated, not twice the length of posterior.

Hab.—Glenbrook, Blue Mountains, N.S.W. (Masters).

Obs.—Apparently an uncommon, but easily recognised species.

283. CERATOPOGON SYDNEYENSIS, sp.n. (Pl. XIII., fig. 40).

♂.—Length of antennæ......	0·030 inch	...	0·76 millimètre.
Expanse of wings........	0·055 × 0·016	...	1·39 × 0·40
Size of body..............	0·055 × 0·020	...	1·39 × 0·50
♀.—Length of antennæ......	0·017 inch	...	0·42 millimètre.
Expanse of wings........	0·045 × 0·018	...	1;13 × 0·45
Size of body..............	0·055 × 0·020	..	1·39 × 0·50

♂ and ♀.—Antennæ, head, and palpi in ♂ black, in ♀ brown. Thorax brown, darker in ♂ than ♀, dull, with minute pale yellow pubescence; pleuræ and metanotum dark brown; scutellum testaceous or ochreous-brown. Halteres white, stem brownish. Abdomen short, robust in ♀, brown, dull, clothed with yellowish hairs. Legs light brown, with brownish hairs. In fore legs tibia ⅓ longer than metatarsus. Wings about length of body, hyaline, densely covered with brownish-yellow pubescence, richly iridescent in ♀, weaker in ♂; veins yellowish-brown. Auxiliary vein not distinguishable; first longitudinal vein reaching costa before base of fifth longitudinal fork; second longitudinal reaching costa somewhat beyond middle of anterior border, in ♂ just beyond base of fifth longitudinal fork, in ♀ opposite tip of

posterior branch of the latter; extremely indistinct trace of third longitudinal fork in ♂; fourth longitudinal fork indistinct at base, anterior branch reaching margin, in ♂ immediately above, in ♀ at, the apex of the wing, posterior branch joining mid-way between tips of anterior branches of the two forks; fifth fork somewhat narrow, posterior branch in ♂ not quite reaching wing-margin.

Hab.—Sydney and environs (Skuse). December and January.

284. Ceratopogon æratipennis, sp.n. (Pl. xiii., figs. 41 and 42).

♂.—Length of antennæ........	0·030 inch	...	0·76 millimètre.
Expanse of wings..........	0.045 × 0.014	...	1·13 × 0·35
Size of body.................	0·040 × 0·017	...	1·01 × 0·42
♀.—Length of antennæ.........	0·015 inch	...	0·38 millimètre.
Expanse of wings..........	0·040 × 0·015	...	1·01 × 0·38
Size of body.................	0·050 × 0·017	...	1·27 × 0·42

♂ and ♀.—Black, opaque; scutellum ochre-yellow. Thorax with yellowish-brown hairs. Halteres brown. Abdomen about ⅓ longer than thorax, clothed with yellowish-brown hairs. Legs light brown, the femora or genua sometimes darker. In fore legs tibia twice the length of metatarsus. Wings in ♂ longer, in ♀ shorter than entire body, pellucid with a delicate yellowish tint, brassy reflections, not so densely pubescent in ♂; costal, first two longitudinal veins, middle cross-vein and basal portion of fourth longitudinal pale brownish. Auxiliary vein very pale and indistinct; second longitudinal vein in ♂ terminating in costa immediately before base of fifth longitudinal fork, in ♀ immediately beyond; the latter vein in both sexes joining immediately beyond middle of anterior border; marginal cell almost, and inner marginal entirely, obliterated by the confluence of the veins; indistinct traces of third longitudinal fork; fourth longitudinal fork obliterated at the base, branches indistinct,

the anterior branch reaching margin a little above apex of wing; fifth longitudinal indistinct.

Hab.—Hexham Swamps, near Newcastle, N.S.W. (Skuse). Common in April.

Obs.—Somewhat allied to *C. scutellatus*, Meig.

285. CERATOPOGON MARMORATUS, sp.n. (Pl. XIV., fig. 43).

♀.—Length of antennæ.........	0·057 inch	...	0·68 millimètre.
Expanse of wings..........	0·057 × 0·025	...	1·44 × 0·62
Size of body.................	0·057 × 0·017	...	1·44 × 0·42

Brown, sometimes very dark brown. Thorax pruinose, with four indistinct spots without that appearance, two short longitudinal lateral ones about the middle, and two median contiguous diamond-shaped spots on the posterior half; sparingly covered with fine pale yellow hairs. Halteres more or less ochreous-yellow. Abdomen about twice the length of thorax, clothed with yellowish bands. Legs light brown, tarsi, more or less yellowish. Femora with an indistinct yellowish ring just before tip, dark brown at tip. Tibiæ yellowish at base. In fore legs tibia twice the length of metatarsus. Wings the length of entire body, pellucid, with pale brownish-grey tint, brown between tip of second longitudinal vein (from opposite base of fifth longitudinal fork) and costa, and with several hyaline spots between the other veins; one includes the middle cross-vein, a larger one under brown costal spot and continuing round to costa, and a smaller round spot between last and apex of wing, two in fork of fourth longitudinal, three or four between fourth and fifth longitudinal veins, one on posterior margin between latter fork, and lastly three or four spots between fifth longitudinal and posterior angle; with a violaceous reflection (except pale spots) when viewed at a certain obliquity; densely clothed with yellowish hairs; veins pale brownish. Auxiliary vein indistinct; first longitudinal much curved at the marginal cross-vein, reaching

costa considerably beyond middle of anterior border and beyond tip of posterior branch of fifth longitudinal fork; second longitudinal joining costa opposite middle anterior branch of fifth longitudinal fork; indistinct trace of third longitudinal fork; middle cross-vein long, not very oblique; anterior branch of fourth longitudinal nearly straight, reaching margin somewhat below apex of wing, posterior branch detached, indistinct; branches of fifth longitudinal fork disappearing before the margin.

Hab.—Sydney and several localities in N.S.W. (Masters and Skuse).

Obs.—A very common insect. Some smaller specimens obtained by Mr. Masters at Blue Mountains differ in darker body and somewhat in wing-spots, but as they are not in good preservation I cannot say if they belong to this species.

286. CERATOPOGON MOLESTUS, sp.n. (Pl. XIV., fig. 44).

♀.—Length of antennæ......	0·015 inch	...	0·38 millimètre.
Expanse of wings........	0·045 × 0·020	...	1·13 × 0·50
Size of body..............	0·050 × 0·015	...	1·27 × 0·38

Deep brown, the legs lighter brown. Thorax with a dull greenish tinge, sparingly covered with yellow hairs. Halteres more or less yellowish. Abdomen short, clothed with yellowish hairs. Tarsi more or less yellowish. In fore legs tibia more than twice the length of metatarsus. Wings about the length of entire body, pellucid, greyish, brownish between tip of second longitudinal and costal from opposite base of fifth longitudinal fork, and with several hyaline spots; the spots very much as in *C. marmoratus*, except that there are two immediately above anterior branch of fourth longitudinal fork, and the spot in fifth longitudinal fork does not or scarcely touches wing-margin; brilliantly iridescent when viewed at a certain obliquity; moderately covered with yellow hairs; veins brownish-yellow. Auxiliary vein indistinct; first longitudinal curved gently upwards to the costa, joining considerably

beyond middle of anterior border and somewhat beyond tip of posterior branch of fifth longitudinal fork; second longitudinal reaching costa beyond middle of anterior branch of fifth longitudinal fork; extremely indistinct trace of third longitudinal fork; middle cross-vein long, not very oblique; anterior branch of fourth longitudinal almost straight, reaching margin at apex of wing, posterior branch detached; posterior branch of fifth longitudinal fork not quite reaching margin.

Hab.—Sydney and generally in N.S.W. (Masters and Skuse); Como, N.S.W. (Dr. Katz). Common from December to April.

Obs.—Generally called "Sand-fly," and a particularly annoying insect in many localities. Some specimens in spirit received from Dr. T. Bancroft of Brisbane seem to belong to this species, which is apparently allied to the European *C. arcuatus*, Winn.

B. Wings entirely naked.

287. Ceratopogon tigrinus, sp.n. (Pl. xiv., fig. 45).

♀.—Length of antennæ......	0·015 inch	...	0·38 millimètre.
Expanse of wings........	0·040 × 0·013	...	1 01 × 0·32
Size of body..............	0·045 × 0·010	...	1·13 × 0·25

Antennæ, head, clypeus, and palpi black. Thorax brown, dull, with two longitudinal stripes and three irregular lateral spots of ochreous; sparingly covered with short brown hairs; pleuræ, pectus, and metanotum dark brown; scutellum light brown. Halteres brown. Abdomen short, robust, dusky brown, clothed with brown hairs. Legs brown, tips of femora and tarsi yellowish; posterior tibiæ incrassated. In fore legs tibia somewhat more than twice the length of metatarsus. Wings about length of entire body, hyaline, glabrous, with opaline reflections; veins distinct, brownish. Auxiliary vein terminating in costa mid-way between base of second longitudinal and tip of first longitudinal; latter reaching costa somewhat beyond middle of anterior border, and opposite middle of anterior branch of fifth longitudinal fork; marginal cross-vein situated close to tip of first longitudinal;

marginal cell about $\frac{1}{3}$ longer than inner marginal, of equal width; second longitudinal meeting costa somewhat beyond tip of anterior branch of fifth longitudinal fork; slight trace of portion of anterior branch of third longitudinal, appearing almost like a wing-fold; fork of fourth longitudinal with a short petiole, base of fork opposite tip of posterior branch of fifth longitudinal, the anterior branch reaching margin immediately below apex of wing; anterior branch of fifth longitudinal fork short, arcuated.

Hab.—Berowra, N.S.W. (Skuse). January.

288. Ceratopogon imperfectus, sp.n. (Pl. xiv., fig. 46).

♀.—Length of antennæ........	— inch	...	— millimètre.
Expanse of wings....... ..	0·031 × 0·011	...	0·62 × 0·27
Size of body................	0·025 × 0·008	...	0·62 × 0·20

Antennæ lost. Black or very deep brown, opaque; legs yellowish; halteres pale yellow. Abdomen short, the width of the thorax. In fore legs tibia not (?) twice the length of metatarsus. Wings the length of entire body, naked, cuneiformly narrowed at base, pellucid, with a delicate brownish tint, and rich cupreous reflections; brown between costal and second longitudinal veins for some distance before their tip; costal, first two longitudinal veins, middle cross-vein and basal half of fourth longitudinal brownish. Auxiliary vein invisible; first longitudinal reaching costa at middle of anterior margin, but considerably before base of fifth longitudinal fork; second longitudinal meeting costa almost opposite tip of anterior branch of fifth longitudinal fork; basal portion of fourth longitudinal, middle cross-vein and second longitudinal almost in one straight line; no trace of third longitudinal; anterior branch of fourth longitudinal entirely missing, posterior branch extremely pale and indistinct, disappearing close to margin a little below apex of wing; fifth longitudinal extremely pale and indistinct, fork very short, both branches disappearing much before the wing-margin, the posterior branch very short.

Hab.—Middle Harbour, near Sydney (Skuse). One specimen in September.

II. Marginal Cross-vein Wanting.

289. Ceratopogon latipennis, sp.n. (Pl. xiv., fig. 47).

♀.—Length of antennæ	0·027 inch	...	0·68 millimètre.
Expanse of wings	0·075 × 0·030	...	1·89 × 0·76
Size of body	0·060 × 0·020	...	1·54 × 0·50

Antennæ, head, clypeus, and palpi light brown; flagellar joints of antennæ more yellowish than the rest. Thorax and scutellum pale dull brownish-ochreous; metanotum brownish; thorax sparingly beset with yellowish hairs; pleuræ and pectus pale brownish or brownish-ochreous. Halteres white. Abdomen short, brown, clothed with yellowish hairs. Legs yellow, all joints slightly tipped with brown, tibiæ also slightly at the base. In fore legs tibia more than twice length of metatarsus. Ungues very long, aculeate, deep brown. Wings very broad, longer than entire body, pellucid with a faint brownish tint, with minute yellowish pubescence chiefly in apical half; veins pale brownish-yellow, first and second longitudinal veins marked with brown immediately before middle cross-vein, also first longitudinal again mid-way between first spot and costa; second longitudinal enormously distended and brown at tip. Auxiliary vein extremely pale and indistinct; first longitudinal reaching costa opposite base of fourth longitudinal fork and mid-way between base and tip of second longitudinal; latter joining costa beyond middle of anterior border; indistinct trace of third longitudinal fork; anterior branch of fourth longitudinal fork reaching margin at apex of wing, posterior detached, or very indistinct at base, joining margin mid-way between tips of anterior branches of fourth and fifth forks; latter fork broad, both branches arcuated, the posterior not quite reaching the margin.

Hab.—Berowra, N.S.W. (Masters). One specimen.

EXPLANATION OF PLATES.

Plate xi,

Fig. 1. Wing of *Chironomus occidentalis* (♀).
Fig. 2. ,, ,, *delinificus* (♂).
Fig. 3. ,, ,, *pulcher* (♀).
Fig. 4. ,, ,, *seorsus* (♀).
Fig. 5. ,, ,, *erebeus* (♀).
Fig. 6. ,, ,, *Tepperi* (♀).
Fig. 7. ,, ,, *oresitrophus* (♂).
Fig. 8. ,, ,, *oresitrophus* (♀).
Fig. 9. ,, ,, *brevis* (♀).
Fig. 10. ,, *Orthocladius annuliventris* (♂).
Fig. 11. ,, ,, *numerosus* (♂).
Fig. 12. ,, ,, *venustulus* (♂).
Fig. 13. ,, ,, *insolidus* (♂).
Fig. 14. ,, ,, *pullulus* (♀).

Plate xii.

Fig. 15. Wing of *Doloplastus monticola* (♂).
Fig. 16. ,, *Camptocladius terjugus* (♀).
Fig. 17. ,, ,, *crassipennis* (♀).
Fig. 18. ,, ,, *invenustulus* (♀).
Fig. 19. ,, *Tanytarsus montanus* (♂).
Fig. 20. ,, ,, *inextentus* (♂).
Fig. 21. ,, ,, *inextentus* (♀).
Fig. 22. ,, ,, *fuscithorax* (♂).
Fig. 23. ,, *Metriocnemus nitidulus* (♀).
Fig. 24. ,, *Tanypus Mastersi* (♀).
Fig. 25. ,, *Isoplastus notabilis* (♂).
Fig. 26. ,, ,, *formulosus* (♂).
Fig. 27. ,, *Procladius paludicola* (♂).
Fig. 28. ,, ,, *pictipennis* (♂).

Plate XIII.

Fig. 29. Wing of *Leptoconops stygius* (♀).
Fig. 30. ,, *Ceratopogon albopunctatus* (♂).
Fig. 31. ,, ,, *æqualis* (♂).
Fig. 32. ,, ,, *saltivagus* (♀).
Fig. 33. ,, ,, *rhynchops* (♀).
Fig. 34. ,, ,, *Mastersi* (♂).
Fig. 35. ,, ,, *insignis* (♀).
Fig. 36. ,, ,, *subnitidus* (♀).
Fig. 37. ,, ,, *minusculus* (♂).
Fig. 38. ,, ,, *nigellus* (♀).
Fig. 39. ,, ,, *10-punctatus* (♀).
Fig. 40. ,, ,, *Sydneyensis* (♂).
Fig. 41. ,, ,, *æratipennis* (♂).
Fig. 42. ,, ,, *æratipennis* (♀).

Plate XIV.

Fig. 43. Wing of *Ceratopogon marmoratus* (♀).
Fig. 44. ,, ,, *molestus* (♀).
Fig. 45. ,, ,, *tigrinus* (♀).
Fig. 46. ,, ,, *imperfectus* (♀).
Fig. 47. ,, ,, *latipennis* (♀).
Fig. 48. Diagram (wing of *Chironomus*) illustrating the terminology of the venation.
Fig. 49. Diagram (wing of *Tanypus*) illustrating the terminology of the venation.

Plate XIV. *bis.*

Fig. 50. Diagram (wing of *Procladius*) illustrating the terminology of the venation.

Fig. 51. Diagram (wing of *Leptoconops*) illustrating the terminology of the venation.

Fig. 52. Diagram (wing of *Ceratopogon*) illustrating the terminology of the venation.

Fig. 53. Diagram (wing of *Ceratopogon*) illustrating the terminology of the venation.

Veins.

Costa *(v. costalis).* A, h.
Transverse shoulder-vein *(v. trans. humeralis).* x.
Auxiliary *(v. auxiliaris).* a, s.
First longitudinal *(v. long. 1ma).* a, B.
Marginal cross-vein *(v. trans. marginalis).* x x.
Second longitudinal *(v. long. 2da),* b, C.
Third longitudinal *(v. long. 3a).* b, D.
Middle cross-vein *(v. trans. media).* x x x.
Fourth longitudinal *(v. long. 4a).* c, d, e.
Posterior cross-vein *(v. trans. posterior).* x x x x.
Fifth longitudinal *(v. long. 5a).* c, f, g.

Obs.—Following the plan adopted by Winnertz in his treatment of the species of *Ceratopogon* (Linn. Entom. VI. p. 13), I have by means of micrometrical measurements divided the wings in the species of all the genera into one hundred parts, thereby being enabled to tabulate the respective positions of the tips of the first, second, and third longitudinal veins between the base and apex of the wing. In the plates I have represented all the wings on the same scale of one hundred divisions, which will be found more useful than if the relative size of the wings had been retained.

NOTES AND EXHIBITS.

Mr. Etheridge exhibited the fossils referred to in his paper.

Mr. Skuse exhibited specimens of sixty-seven species of Chironomidæ described in his paper; a Tineid bred from a species of stag-horn fern growing in Mr. Macleay's garden; a young plant from Samoa growing like *Bryophyllum* or one of the Gesneraceæ from the leaf; and a female gall and Coccid, *Brachyscelis duplex*, obtained by Mr. Maiden on *Eucalyptus piperita*, at Little Zig-zag, Blue Mountains, with the apical processes of the gall projecting upwards instead of outwards.

Also an excellent drawing by Mr. G. V. Hudson of Wellington, New Zealand, of the imago and enlarged wing of a Dipterous fly which is phosphorescent in its larval condition. In 1886 both Mr. Meyrick and Mr. Hudson observed these luminous larvæ for the first time inhabiting the banks of a shady creek in New Zealand, and although the latter gentleman has since repeatedly tried to obtain the perfect insect by breeding, his efforts have only just recently been rewarded in obtaining a single specimen. As Baron Osten-Sacken suspected (Ent. Mon. Mag. XXIII. p. 133) the insect belongs to the Mycetophilidæ, but, accepting the drawings as correct, the fly must be referred to a new genus of the section Ceroplatinæ.

Mr. Ogilby exhibited two examples of the rare *Anomalops palpebratus*, Bodd., sp., a deep sea fish provided with a luminous lobe beneath the eye. Bleeker and Kner place the genus in the family *Berycidæ*, but it is probable that it is an aberrant form of the *Carangidæ* as stated by Günther. Bleeker's generic name, *Heterophthalmus* having been previously used by Blanchard for a genus of Coleopterous insects, must give place to Kner's *Anomalops*. Only eight specimens are known, four from Amboina and Manado, one from Fiji, one from the Paumoto Archipelago, and our two from the New Hebrides whence they were brought by Captain Braithwaite.

Mr. Froggatt showed a specimen of *Girella tricuspidata* prepared to illustrate a mode of preserving and exhibiting fish by casting in plaster of Paris, lining the mould with the skin and so filling it.

A portion of the collections of seaweed referred to by the President was exhibited, and in reference to them Mr. Deane expressed the hope that the opportunity of referring to a named collection would help to promote among the members of the Society the study of this section of the Flora.

The President exhibited a specimen of *Voluta magnifica* obtained at a depth of 70 feet below sea-level at Stockton Pit, Newcastle.

The President pointed out that the stems with prominent ridges of cork, shown at the February meeting, probably belong to *Mezoneurum brachycarpum*, Benth., [Fl. Aust. II., 278; also Wing's "Southern Science Record," April, 1882, where Baron v. Mueller gives some notes upon this plant and an allied species *M. Scortechinii*]. The flanges and cylindrical projections of cork which clothe the stems of this climber probably serve in place of hooks or prickles—which in this species are rudimentary—to support the plant among the branches of other trees.

WEDNESDAY, 29TH MAY, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

Mr. Walmsley Stanley was present as a visitor.

The President announced that there would be no Excursion in June.

DONATIONS.

"Royal Dublin Society—Scientific Transactions." Series ii. Vols. I. (25 Parts); II. (3 Parts); III. (Parts 1-10), (1877-85); "Scientific Proceedings." n.s. Vols. I. (3 Parts); II. (7 Parts); III. (7 Parts); IV. (9 Parts); V. (Parts 1 and 2), (1877-86). *From the Society.*

"The Australasian Journal of Pharmacy." Vol. IV., Nos. 40 and 41 (April and May, 1889). *From the Editor.*

"Bulletin de la Société Royale de Géographie d'Anvers." Tome XIII., fasc. 3 (1889). *From the Society.*

"Abstracts of Proceedings of the Zoological Society of London," February 5th and 19th; March 5th and 19th; April 2nd, 1889. *From the Society.*

"Mémoires de la Société de Physique et d'Histoire naturelle de Genève." Tome XXX., Première Partie (1888). *From the Society.*

"Mittheilungen aus der Zoologischen Station zu Neapel." Band VIII., Hefts 3 and 4 (1888). *From the Zoological Station.*

"Proceedings of the Royal Society of London." Vol. XLV., Nos. 274 and 275 (1888-89). *From the Society.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CVIII., Nos. 5-8 (1889). *From the Academy.*

"The Journal of Conchology." Vol. VI., No. 1 (1889). *From the Conchological Society of Great Britain and Ireland.*

"Archiv für Naturgeschichte." 54th Jahrg. Band I., Heft 2 (1888). *From the Editor.*

"Proceedings of the United States National Museum." Vol. XI. (1888), Sheets 12-15. *From the Museum.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 303-305 (1889). *From the Editor.*

"Annales de la Société Royale Malacologique de Belgique." Tome XXII. (1887); "Procès-Verbaux." (January-June, 1888). *From the Society.*

"Feuille des Jeunes Naturalistes." No. 222 (April, 1889); "Catalogue de la Bibliothèque." Fasc. No. 5 (1889). *From the Editor.*

Two Pamphlets by M. Adrien Dollfus—"La Station Zoologique de la Société Néerlandaise de Zoologie;" "Le Muséum de Londres—(Notes et Impressions)." *From the Author.*

"Transactions of the Cambridge Philosophical Society." Vol. XIV., Part 3 (1889); "Proceedings." Vol. VI., Part 5 (1888). *From the Society.*

"United States Geological Survey—Geology and Mining Industry of Leadville, Colorado," with Atlas. By Samuel F. Emmons. *From the Director.*

"Bulletin of the Essex Institute, Salem." Vol. XIX. (1887); "Visitors' Guide to Salem." Published by Henry P. Ives. *From the Institute.*

"The Journal of the Cincinnati Society of Natural History." Vol. XI., Nos. 2 and 3 (1888). *From the Society.*

"New York Academy of Sciences—Annals." Vol. IV. Nos. 5-8 (1888); "Transactions." Vol. VII., Nos. 3-8 (1887-88). *From the Academy.*

"Acta Societatis Scientiarum Fennicæ." Tomus XV. (1888); "Bidrag till Kännedom af Finlands Natur och Folk." Häftet XLV.-XLVII. (1887-88); "Ofversigt af Finska Vetenskaps-Societetens Förhandlingar." T. XXVIII & XXIX. (1885-87); "Finska Vetenskaps-Societeten, 1838-88, dess Organisation och Verksamhet." *From the Society of Sciences of Finland.*

"Journal and Proceedings of the Royal Society of New South Wales." Vol. XXII., Part 2 (1888). *From the Society.*

"Siebenter Jahresbericht des Naturwissenschaftlichen Vereins zu Osnabrück für die Jahre 1885 bis 1888." *From the Society.*

"The Victorian Naturalist." Vol. VI., Nos. 1-2 (May-June, 1889). *From the Field Naturalists' Club of Victoria.*

"The Journal of the College of Science, Imperial University, Japan." Vol. II., Part 5 (1889). *From the President of the University.*

"Natuurkundig Tijdschrift voor Nederlandsch-Indië, uitgegeven door de Konink. Natuurk. Vereeniging in N.-I." Deel XLVIII. (1888). *From the Society.*

"Jahresbericht des Vereins für Naturwissenchaft zu Braunschweig für die Vereinsjahre" 1880-81; 1881-82 und 1882-83; 1883-84 bis 1885-86. *From the Society.*

"Journal of the Royal Microscopical Society, 1889." Part 2 (April). *From the Society.*

SPECIMENS OF PLANTS COLLECTED AT KING GEORGE'S SOUND BY THE REV. R. COLLIE, F.L.S.

By The Rev. Dr. Woolls, F.L.S.

The specimens collected by the Rev. R. Collie, though containing nothing new, are nevertheless highly interesting. The Rev. gentleman seems to have visited part of the same ground which the eminent Robert Brown examined in the early portion of the present century, when he was attached as naturalist to Flinders's expedition, and when further he collected some of the same species which attracted Mr. Collie's attention. King George's Sound, therefore, has a history in the progress of botanical science, having as it were acquired classic celebrity from the labours of Brown, and from the appropriate names which he gave to many of its plants. From the small collection of Mr. Collie, only a limited idea can be formed of the peculiarity exhibited by our South-western Flora; but, so far as the collection goes, especially in the orders Leguminosæ, Myrtaceæ, Proteaceæ, and Epacrideæ, it tends to illustrate the fact, so strikingly enunciated by Sir J. D. Hooker in his " Introductory Essay on the Flora of Tasmania," that the proportion of species in S. W. Australia is much greater than in the S.E., and that the striking differences in the genera and species of the two quarters open for consideration questions of deep significance in regard to the creation and distribution of species. Though Hooker's work was published in 1859,—that is about twenty years before the completion of the *Flora Australiensis* by the united labours of Bentham and Mueller, his views are still found to be correct, whilst the probability that Western Australia was the centrum of Australian vegetation is still further confirmed by the opinions of our eminent Geologist Mr. Wilkinson, and the recent calculations of Baron Mueller in his Census of Australian

Plants. With regard to the distribution of the latter, it appears that, of the known species in Australia now reckoned about 9000, they occur respectively in

Western Australia	3559
South Australia	1904
Victoria	1904
New South Wales	3260

This calculation fully bears out the importance of the Western Flora, whilst the fact remains, in reference to the Floras of the S.W. and S.E. regions, that the genera of the former are much larger than those of the latter, and the species proportionally more numerous.

Following is a list of the plants furnished by Mr. Collie :—

EPACRIDEÆ

1. *Leucopogon alterniflorus*, R.Br.
2. *Andersonia sprengelioides*, R.Br.
3. *A. micrantha*, Sond.

MYRTACEÆ.

4. *Hypocalymma strictum*, Schau.
5. *Agonis flexuosa*, Schau.
6. *A. theœformis*, Schau.
7. *A. marginata*, Schau. (?)
8. *Melaleuca striata*, Labill.
9. *Eucalyptus marginata*, Sm.

PROTEACEÆ.

10. *Petrophila rigida*, R.Br.
11. *Adenanthos cuneata*, Labill.
12. *Conospermum flexuosum*, R.Br.
13. *Franklandia fucifolia*, R.Br.

14. *Persoonia longifolia*, R.Br.
15. *Grevillea Brownii*, Meissn.
16. *Hakea trifurcata*, R.Br.
17. *Banksia grandis*, Willd.
18. *B. Brownii*, Baxt.
19. *B. coccinea*, R.Br.

LEGUMINOSÆ.

20. *Psoralea pinnata*, W. (Int.)
21. *Phyllota barbata*, Benth.
22. *Jacksonia spinosa*, R.Br.
23. *J. horrida*, DC.
24. *Daviesia divaricata*, Benth.
25. *Bossiæa Preissii*, Meissn. (?)
26. *Acacia pulchella*, R. Br.
27. *A. alata*, R.Br.

COMPOSITÆ.

28. *Pithocarpa corymbulosa*, Lindl.
29. *Olearia cassiniæ*, F.v.M.

POLYGALEÆ.

30. *Comesperma confertum*, Labill.

PITTOSPOREÆ.

31. *Sollya heterophylla*, Lindl.
32. *Billardiera variifolia*, DC.

RUTACEÆ.

33. *Boronia spathulata*, Lindl.

UMBELLIFERÆ.

34. *Xanthosia rotundifolia*, R.Br. (?)
35. *Trachymene eriocarpa*, Benth. (?)

RESTIACEÆ.

36. *Anarthria scabra*, R.Br.
37. *Lepyrodia stricta*, R.Br. (?)
38. *Anarthria prolifera*, R.Br.

Of the three Epacrids not one of them extends to the Eastern Coast. The genus *Andersonia*, containing 20 species, is limited to W. Australia. Some of them approach our *Sprengelia*, but they differ materially in the shape of the corolla and its æstivation. *Leucopogon alternifolius*, which was collected by Brown during his voyage with Flinders, has some resemblance to our *L. amplexicaulis*, but it is smaller in every part. It seems rare, as Mr. Bentham's only specimen was from Brown's collection. Of the 118 species of *Leucopogon*, 23 only occur in N. S. Wales, but of the genus *Epacris*, none have been found in W. Australia.

The plants of Myrtaceæ belong to four genera, two of which are not represented in N. S. Wales, viz., *Hypocalymma* and *Agonis*, the former with 12 and the latter with 11 species, all in W. Australia. The Rev. B. Scortechini found a species of *Agonis* on Stradbroke Island (Queensland), and that is described by Baron Mueller as being a remarkable species, extending the limits of the genus to the Eastern Coast. *Melaleuca striata* is strictly a western species, though resembling some of the eastern ones. Nearly 100 species of the genus are described, but only 17 extend to N. S Wales, and of these *M. acuminata*, *M. parviflora*, *M. uncinata*, and *M. leucadendron* are common to W. Australia. It should be considered in studying the distribution of species, that *M. leucadendron* is widely spread in the Oriental Archipelago and Malayan Peninsula. *Eucalyptus marginata* is the Jarrah of W. Australia, and is reckoned among the forest resources of the west (Baron Mueller's Report). Baron Mueller calculates that of the 150 Eucalypts now pretty well known, 80 are found in W. Australia. It is strange that only *E. rostrata* and a few of the smaller kinds, designated "Mallee," are common to N. S. Wales and W. Australia.

The Leguminosæ (with the exception of *Psoralea pinnata*, a plant introduced from the Cape of Good Hope, and found also near Sydney) have species of each genus in N. S. Wales, but not identical with any in the west. *Phyllota barbata* does not appear so variable as our *P. phylicoides*, and it is well distinguished by its fringed style. *Jacksonia horrida* and *J. spinosa* differ very much from our *J. scoparia* (which is leafless and grows to be a small tree), and they are rigid shrubs with angular and striate branches. In the *Flora* 28 species are described, all, with one exception, western. But since the publication of that work, the Baron has recorded seven new ones in his *Fragmenta*, three of which occur in the eastern part of Australia. *Daviesia divaricata* is a leafless plant with sulcate spinescent branches. Of 55 species of *Daviesia*, only 13 occur in N. S. Wales. The specimen of *Bossiæa* being only in leaf is doubtful, but in that genus the species are more numerous in the west than in the east, nor are any of them identical. Of the large genus *Acacia*, numbering about 300 species, *A. alata* and *A. pulchella* are remarkable, the one for its bifariously decurrent phyllodia, and the other for its minute pinnate leaflets. Both of these plants were collected by Brown and named by him. Of the Acaciæ 122 occur in W. Australia, and less than 100 in N.S.W. Very few species are common to all the Australian Colonies.

The Proteaceæ belong to eight genera, six of which extend to the east, but the species are different. *Petrophila rigida* is similar to some of ours, but more rigid in foliage. *Conospermum flexuosum* is an under-shrub with divaricate angled branches, and unlike our species in aspect. *Persoonia longifolia* and *Grevillea Brownii* are similar in character to some of the eastern species, but *Hakea trifurcata* has two kinds of leaves varying very much in shape. Of the three Banksias, *B. grandis* is distinguished by its large pinnatifid leaves, *B. coccinea* is remarkable as being one of the species figured by F. Bauer, and *B. Brownii*, Baxt., for its long, narrow whorled leaves. *Adenanthos cuneata* and *Franklandia fucifolia* belong to genera exclusively western, the one having cuneate silky leaves, and the other terete ones repeatedly forked.

W. Australia is rich in Proteaceæ, and the large genus *Dryandra* occurs nowhere else.

Of the two Composites, *Pithocarpa corymbulosa* is the only species of the genus, and, though approaching *Humea*, differs from it in habit and involucre. It is a small plant with long slender stems forming nearly leafless panicles of little white flowers. *Olearia cassiniæ* seems peculiar to King George's Sound and Lake Leven, and belongs to a series of plants differing very little from each other. Indeed, when comparing it with some of our Eastern species, especially *O. ramulosa*, it is very difficult to say whether they are all distinct species or not.

Having glanced at the most striking of Mr. Collie's specimens, it may not be out of place to make some general observations on our flora as bearing on the differences between the eastern and western species and genera. Mr. Bentham's opinion was that the predominant portion of the Australian flora was indigenous, although there appeared to be a very remote ordinal, tribual, or generic connection with African forms. He also recognised on the one hand, an ancient connection between Australia and India, and on the other, a still more ancient one, through the Alpine Flora of Victoria, Tasmania and New Zealand, even to the American Continent. Whilst fully acknowledging the sagacity of the distinguished Botanist as accounting for the diversity of forms found in Australia, the difficulty still remains of accounting for the great differences in the genera and species of S.W. and S.E. Australia. Sir J. D. Hooker, after having expressed an opinion that Western Australia might be regarded as the centrum of Australian vegetation, whence a migration proceeded Eastward and led gradually to the differentiation of specific forms, suggests that the inquiry cannot be pursued satisfactorily without a knowledge of the comparative geologic ages of the respective regions. On this question I am permitted to quote a passage from a communication addressed to me by our indefatigable Geologist Mr. Wilkinson :—"I do not think that the Western Australian Flora can be rightly understood until studied in connection with the

distribution of the Tertiary Flora, from which the recent one has been developed, also with the changes in the physical geography of the continent which have directed that distribution. Imagine the luxuriant condition of the vegetation, especially upon South-eastern Australia, during the great rainfall period which immediately preceded the recent flora, when the great Riverina Plains were formed by higher floods than those occurring at the present day; and when crocodiles sported in swampy jungles along the Darling River in places 15 miles distant from the river, and now dry plains! In that period Lake Torrens and Lake Eyre were probably connected with Spencer's Gulf and stretched northward far into the continent. Then, in the previous Miocene times, Australia stood at a lower level, and *the ocean occupied all that low country between Spencer's Gulf and Western Australia.* Then again in the Cretacean period, about *two-thirds of Australia must have been under the ocean.* Under these conditions how did the plants migrate? And with alteration of the form of sea and land, the ocean currents, with warm or cold water, as the case might have been, varied accordingly and affected the temperature of the climate of the different localities; for along the coast *near Adelaide* the rocks are grooved with *glacier* striæ. These changes of temperature, therefore, and of rainfall, must at times have greatly favoured the growth of certain plants, and the diminution or extinction of others until the present distribution resulted." It would be presumptuous in me to pursue this subject any further, but I can easily imagine that, at a period when Eastern and Western Australia were separated by an intervening sea, the migration of many plants from the west (a migration which had probably commenced) was rendered impossible; and this may account for the fact that so many forms of vegetation have remained isolated from the rest of Australia, and that the flora of the S.W. is richer than that of the S.E. Anyone by studying the census of plants, as furnished by Baron Mueller, must see how, in some genera truly Australian, the species are all limited to the west, and how, in other genera, a few species only have found their way east. How can such things have happened unless some great physical changes have

interrupted the ordinary sequence of events? If, as enunciated by Baron Ettingshausen, the whole existing vegetation of the world can in its development be traced to a universal flora of bygone geologic ages, and if, as stated by Mr. Wilkinson, the process of development through countless periods has been accompanied by catastrophes such as can scarcely be imagined in these days, a theory may doubtless be constructed as satisfactory to the Botanist as to the Geologist. However that may be, the hand of infinite wisdom may be traced in all the works of the Creator, as tending to the gradual development of His purposes, the preservation of species adapted to different soils and climates, and a providential care for the wants of humanity.

BACTERIOLOGICAL NOTES.

By Dr. Oscar Katz.

1.—Note on the Bacillus of Leprosy.

Since its discovery by Hansen and Neisser, about ten years ago, the bacillus of leprosy has been made the subject of numerous researches, with a view to its artificial cultivation, and its behaviour when experimentally transmitted to man or animals.

With reference to the first point, the only positive and unobjectionable results appear to have been obtained by G. Bordoni-Uffreduzzi,* who cultivated the bacilli in question from the marrow of an individual who had died from leprosy. Any attempts made by him to cultivate the micro-organism from the skin, spleen, liver and lymphatics of the dead subject, failed.

Some cultivation-experiments, which I undertook with material from living lepers, yielded negative results. For that purpose, I visited on two occasions the Asylum associated with the Coast Hospital at Little Bay, near Sydney, where at the time several lepers were, with one exception (native of Java), all Chinamen.

The material for experiment was derived from typical non-ulcerating tubercles of the hand. In each case a suitable tubercle was selected, and after having caused the man to wash his hand thoroughly with soap and water, I applied for some minutes a

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* "Ueber die Cultur der Leprabacillen." Von Dr. G. Bordoni-Uffreduzzi *Zeitschrift für Hygiene, Dritter Band, Erstes Heft*, 1887, p. 178.

5 p.m. watery solution of corrosive sublimate, whereupon the spot was carefully rinsed with a sterile 0·6 p.c. watery solution of sodium-chloride. The tubercle was then cut open through its whole mass by means of a sterilised scalpel. The blood which appeared first was rejected, but subsequently samples were taken from the bottom of the wound by means of a platinum-loop, and at once transferred on or into the culture-material.

(i) June 6, 1887. The material was supplied by a Chinaman who suffered from characteristic tuberous leprosy. Samples of blood from a rather large nodule on the right hand were transferred to half-a-dozen test-tubes on to the inclined surface of coagulated human hydrothorax fluid, which had been obtained from the Little Bay Hospital some time previously. Besides, one tube containing such fluid not coagulated, was charged with some of the leprosy-blood.

I will mention at once that the subsequent microscopical examination of cover-glass preparations of this blood showed only a very limited number of leprosy-bacilli.

A corresponding experiment was made with a small tubercle on the left hand of the same leper. Samples of blood taken from it served for sowing an equal number of tubes as before. This blood, as was afterwards proved by the microscopical examination, contained an enormous quantity of leprosy-bacilli.

On my return to Sydney, but not until the following day, all the tubes were placed in a thermostat, where they remained, at a temperature of 36° C. to about 34° C., for about two months. During this time they were occasionally inspected, but the result of the experiment was negative, in so far as I was unable to trace any multiplication of the bacilli.

(ii) November 21, 1887. Two Chinamen were selected, one of them being the same as above, the other having been brought to the Asylum since my last visit there. In each case a typical

tubercle of the hand was picked out for yielding the necessary material of blood, with which the following tubes were charged: for each case, five containing peptone-glycerine-agar, solidified at an inclined surface. [The composition was—meat-broth as usual; agar-agar 1 p.c., peptone 1 p.c., glycerine 6 p.c. (in weight), sodium-chloride 0·6 p.c.; reaction slightly alkaline.]

On microscopic examination of each of the two descriptions of blood, leprosy-bacilli were seen to be present in moderate numbers.

The tubes (fourteen in all) were placed, in the evening of the same day, in a thermostat, in which they were kept for a month, at a temperature of about 37°C. At the end of this period the tubes were still sterile; the pocket-lens could not discover any sign of growth having taken place in them.

As to the question whether leprosy is inoculable into animals or not, the opinions still differ. The possibility of its contagiousness in regard to man is now proved beyond doubt. It will be remembered that Father Damien, who died the other day, is said to have contracted the disease while engaged in his mission work among the lepers at Honolulu. The contagious nature of the disease has, in more than one example, been made manifest, as if by experiment, through vaccinating (against small-pox) with lymph derived from persons who subsequently exhibited symptoms of leprosy.

A variety of animals, such as rabbits, guinea-pigs, cats, etc., have been experimented upon, in order to ascertain whether, or under what conditions, leprosy, or at least something like it, can be communicated to them. It seems as if in certain animals and under certain conditions, leprosy-bacilli can be brought to multiply, thereby causing changes similar to what takes place in leprosy as it occurs naturally in human beings.

I can offer the following experiment. On the 6th June, 1887, a number of sterilised silk-threads were soaked with fresh leprosy-blood, of the same origin as that from which samples for cultivation were derived (see above), and placed in sterile, cotton-wool stoppered test-tubes. Those which were steeped in the blood exceedingly rich in bacilli, were used, soon after my return to Sydney, for inoculating a guinea-pig and three house-mice. The guinea-pig, a full-grown specimen, received some of the silk-threads in a small subcutaneous pouch made at the inner side of the left thigh. At the point of inoculation there was noticed, after some time, a small hardened mass, which, however, disappeared again gradually. The animal was not any further operated upon. It is alive up to the present (that is, after two years), and never showed any symptoms of disease.

The three mice received one silk-thread each subcutaneously at the root of the tail. They died within about a month, without exhibiting, at the post mortem examination, anything that looked suspicious. Leprosy-bacilli were not found.

2.—On "Air-gas" for Bacteriological Work

When, a year ago, the Intercolonial Commission, appointed to inquire into, and report on schemes for the extermination of rabbits in Australasia, decided to erect a laboratory on a little island (Rodd Island) in a western portion of Port Jackson (called Iron Cove), in order to have certain infectious diseases tested, the question arose as to how this laboratory should be supplied with gas. Although the Island is only a few hundred yards from the mainland, where ordinary coal-gas was already in use, it was considered as too hazardous to conduct such gas across to the Island, on account of the formation of the bottom of the water at that place. The only way, therefore, to get out of the difficulty, was to manufacture the required gas on the Island itself. After

some deliberation, I decided to employ for this purpose a Müller's "Alpha Patent Gas-making Machine."

This apparatus produces gas in the shape of a mixture of atmospheric air and the vapour of gasolene or petroleum spirit (composed of carbon and hydrogen); this mixture is called "air-gas." By means of weights, atmospheric air is pumped through a drum into a chamber, where it becomes impregnated or "carburetted" with the vapour of that very volatile liquid. It is thus turned into gas; as such it passes into a small gasometer ("governor"), "whence it supplies automatically what is required for the burners, no matter how many are in use."

The machine used by me was a so-called 40-light one, in other words, one able to yield 200 cubic feet of gas per hour. A substantial little house, adjoining the laboratory, was specially built for it; this house also contained the store gasolene. Pipes were conducted all through the laboratory; the gas was employed both for heating and lighting.

My experience with this gas—I know it now for nearly a year—goes to show that it is, on the whole, well adapted for laboratory researches in cases where coal-gas cannot be easily obtained. The whole apparatus requires only little room; the processes of filling in fresh gasolene, or of winding up the weights, take but little time. The knowledge of the way in which the machine works, and how it will give satisfactory results, must, of course, be acquired.*

It speaks well, I think, for the gas manufactured in the above-stated manner, that by aid of some thermo-regulator, and a little

* For a proper evaporation of the gasolene, it is necessary that the gas-making machine should be kept at not too low a temperature. In a climate such as that of Sydney, the prevailing temperatures all through the year are favourable to the manufacture of "air-gas." In colder places, in winter it will become necessary to arrange for special heaters in the gas house.

extra attention, it can without risk be used for heating thermostats. For instance, I wanted a temperature in the thermostat of 38°C.; by means of an Argand burner supplied with such gas, and of a Reichert-Babes thermo-regulator, this temperature was kept up, within a few tenths of a degree, for weeks.

Bunsen's burners can only discriminately be used when working with this gas, which is mostly too rich in carbon for these burners to give a non-luminous or almost non-luminous flame. When the gas gets poorer, that is, when it contains more atmospheric air, Bunsen's burners can with advantage be taken for the purpose of heating. Fletcher's burners, which have a large opening stretched over with strong wire-gauze or perforated metal, answer best for the gas, when intended for heating, say, steam-sterilisers or copper-boxes. For sterilising instruments, platinum-wires, glass-tubes, etc., I generally used a Fletcher's burner of long cylindrical shape with a flattening-out at the top, which was covered with wire-gauze.

I should add that the light of this gas from an Argand burner is admirably fitted for working with the microscope.

AN ATTEMPT TO SYNCHRONISE THE AUSTRALIAN, SOUTH AFRICAN, AND INDIAN COAL MEASURES.

PART I.—THE AUSTRALASIAN AND NEW ZEALAND FORMATIONS.

By Professor Stephens, M.A., F.G.S.

PREFATORY NOTE.

The following attempt to obtain a general view of the Geological History of Australia and New Zealand between the close of the Devonian and the commencement of the Cretaceous periods, might not unfairly be called a "summary of summaries," or "comparison of comparisons;" since it accepts the outlines as drawn by competent authorities each for his particular district, places them side by side, and endeavours to unite them by transverse lines of isochronism. The same attempt has often been made with more or less success. But it is in the nature of things that our present conclusions on these matters can only be provisional, and will require modification and adjustment with every new advance in our knowledge.

The works to which I shall refer generally, and from which I shall quote without further notice, are the abstracts of the latest results of Geological work in the various colonies as follows, viz.:—In New South Wales, the Notes by C. S. Wilkinson, Government Geologist, in the annual reports of the Department of Mines; in Victoria, the Manual of Physical Geography and Geology by R. A. Murray, Geological Surveyor for the Department of Mines (Government Printing Office, Melbourne, 1887); in Queensland, the Handbook of Queensland Geology, by R. L. Jack, F.G.S., &c., Government Geological Surveyor; in Tasmania, a paper by R. M. Johnston, F.L.S., &c., in P.R.S.T., 1887; in New Zealand from the Outline of N.Z. Geology, by Sir J.

Hector, 1886. I have also used the Fossil Flora of the Coal, &c., by Tenison-Woods, in our Proceedings for 1883; Fossil Flora of E. Australia, &c., by Dr. O. Feistmantel, Proc. Roy. Soc. N. S. Wales, 1880, p. 103; Geology of Tasmania, by Johnston, Hobart, 1888; Invertebrate Fauna of the Hawkesbury, &c., by R. Etheridge, jun., Sydney 1888; Capt. F. W. Hutton on the Geology of New Zealand. Q.J.G.S., 1885, p. 191, &c., &c.*

I take this opportunity of expressing my extreme regret that in discussing Dr. Waagen's paper (Proc. Linn. Soc. ser. ii., Vol. III. p. 1802). I had omitted to refer to the sources from which it was mainly derived, Dr. Blanford's Montreal Address (B. A. Report for 1884, p. 691).

In the discussion of the true correlations between the Australian, South African, and Indian Coal Measures there seems—at least from my point of view—to be betrayed a kind of indefiniteness as to the lines upon which an enquiry which is as much Geographical as Geological should be prosecuted.

The problem set for solution has now been shown to be not so much purely palæontological as dependent on the reconstruction of ancient climates by the revelation of ancient Geographical conditions, such as position, extent and elevation of land surfaces, direction and strength of marine and atmospheric currents, and the alternations of glacial or interglacial periods caused by the varying eccentricities of the earth's orbit, in combination with that rotation of the axis which at long intervals bring the Northern and Southern Hemispheres each in its turn into Summer or Winter perihelion.

Regarding the *principles* of Dr. Croll's theory as sufficiently established, though unable to follow his developments of those principles with the same degree of acceptation, I cannot conceive

* I have purposely refrained from quoting from any author not easily accessible in this country, thinking that these Abstracts are sufficient for my purpose.

that we can properly correlate the phenomena of the Coal Measures of India and Australia, formations accumulated in opposite hemispheres, and different latitudes, by direct comparison.

The more reasonable course would be, I think, to investigate as fully as possible, the whole question in the Southern Hemisphere before entering upon its bearings upon the analogous question in the Northern.

But the opposite course has been pursued, owing probably to the far more perfect knowledge which has been gained of Indian Geology by the skilful, energetic and brilliant labours of the Geological staff of that country, than is as yet available for Australia. New Zealand, indeed, and Victoria have set an example which has been very timidly followed by the other colonies. Nevertheless, in spite of many difficulties and distractions the excellent geologists—too few, unfortunately, for the work—who are now engaged in these researches, have collected a great mass of information, out of which a connected history of this portion of the Southern Hemisphere may be provisionally constructed; and this paper is a humble essay in that direction.

To commence with New South Wales.

I think it may be convenient to give a brief summary of Mr. Wilkinson's report so far as concerns the period in question, even though it be familiar to all present, since inquirers away from Sydney often want and find it difficult to obtain this kind of information. Mr. Wilkinson here repeats that the Lower Carboniferous beds with *Lepidodendron*, *Calamites*, *Sigillaria*, &c., have been much disturbed, being tilted at all angles, and at the Copeland Goldfield, like the corresponding Maitai rocks of N.Z., traversed by auriferous quartz reefs, yielding from 1 to 15oz. per ton. Other beds are rich in marine carboniferous fossils. The Upper Carboniferous (unconformable) commence with marine strata of great thickness, implying long continued depression, which are very rich in characteristic fossils, succeeded by plant beds and coal seams (Greta, Anvil Creek, West Maitland), in which a flora which has been termed Mesozoic is abundant,

displacing entirely the preceding types of vegetation. These coal measures are probably also represented at Hartley, Joadja Creek, Mt. Kembla, &c. Upon these rest the Upper Marine Beds, indicating another period of depression, and exhibiting a similar fauna with the Lower, with coarse and fine conglomerates containing striated boulders and yielding unmistakable evidence of Glacial action. (These are regarded by Mr. T. Oldham of the Indian Geological Survey as equivalents of the Talchirs.) Above these Upper Marine (Carboniferous) beds come the Middle Coal Measures, worked near East Maitland and at Rix's Creek, Singleton. Then about 2000 feet of strata without workable coal, and then again the Upper or Newcastle Coal Measures. These Middle and Upper Coal Measures contain *Glossopteris* (8 species), *Gangamopteris angustifolia*, *Phyllotheca Australis*, *Vertebraria Australis*, &c., with *Urosthenes Australis*. [*Urosthenes* is a genus of Ganoids which occurs also in the Carboniferous of Britain and North America, and not later. There seems therefore to be no good reason for separating the Newcastle beds from the rest of a series which is, up to its Upper Marine beds, undoubtedly Carboniferous in the British sense.]

It used to be assumed that the Hawkesbury formation immediately succeeded the Upper Coal Measures. Mr. Wilkinson, however, some years ago pointed out that on the right of the Shoalhaven, near Jordan's crossing, the Coal Measures had been eroded to a considerable extent before the deposition of the overlying rocks. I myself had long ago observed at Bulli, Mount Victoria, Hassan's Walls, &c., a series of red shales which appeared to intervene between the Hawkesburys and the Coal Measures, and had also noticed that a formation older than the Hawkesbury cropped out from under it upon the coast near Narrabeen. This I supposed to be the upper portion of the Coal Measures, and mentioned it as such to Mr. Wilkinson, who with Mr. David examined the ground, with the surprising result that these Narrabeen beds turned out to be a portion of the Clarence River series, yielding as they do, not *Glossopteris*, *Gangamopteris* and *Vertebraria*, but *Tæniopteris Daintreei*, *Alethopteris*

Australis, and *Thinnfeldia odontopteroides*, which are characteristic of that series. And at the same time these beds are found to correspond to the chocolate or red shales just mentioned. (These appear also about Coal Cliff and in the bores which have been put down between Sydney and Illawarra.) In a paper read April, 1885, before this Society, the Rev. J. Milne Curran maintained that the Clarence River beds are, on the fossil evidence, older than the Hawkesbury, and that the Ballimore beds near Dubbo are the first in succession above the Newcastle Coal Measures.

Mr. MacKenzie, the Examiner of Coalfields for New South Wales, has quite recently enlarged our knowledge of these most western coalfields by the discovery of *Glossopteris*, which is strong evidence for even a more remote date than that arrived at by Mr. Curran.

But a still more interesting fact has been ascertained by Mr. Wilkinson, as he has kindly informed me, in a recent official journey through the Clarence River district. He finds that the Narrabeen beds are at the base of the Clarence series, about 300 feet in thickness (on a rough estimate); that they contain coal seams which may be of some, at least, local value; and that they are succeeded by the Hawkesbury beds, which are again (in the Clarence River district) overlaid by the Upper Clarence beds, which also contain coal seams. This is an extremely important discovery, and clears up many difficulties.

I may, I hope, be pardoned if I here quote a few words from a paper on the Geology of the Clarence River district, read before this Society in December, 1883:—"The road from Grafton to Buccarumbi runs through a poor country of sandstones and shales, undulating in the valleys, but broken by ranges of mural precipices closely resembling the escarpments common in the Hawkesbury sandstone. The false bedding or oblique stratification so common in the latter series is equally predominant here, and the rock faces are excavated by atmospheric action into caves or 'gibber gunyas' of exactly the same character as those on the

shores of Port Jackson or in the gullies of the Blue Mountains. The vegetation is also so similar that it is only by a kind of effort that one remembers that the formation is not the same." I think this passage is an amusing though rather humiliating illustration of the manner in which preconceived ideas may lead to the misinterpretation of obvious phenomena, even when they have been correctly observed.

The sequence of these formations appears to be as follows:—The Newcastle beds are succeeded by a blank in the record, indicating a period of unknown length, during which the Glossopteris flora was entirely swept away, not by any sudden cataclysm, we may be sure, but by the gradual alteration of climatic conditions. It may very probably have been a period of depression corresponding with an actual glacial period in higher southern latitudes, and contemporaneous with the formation of the Bacchus Marsh conglomerates, of which more hereafter.

To the same period the Estheria shales of 500 feet in thickness, proved by Mr. David, may perhaps belong. And the conglomerates of Lake Macquarie, Murrurundi, Wingelo, (?) &c., which rest upon the greatly denuded coal measures, may probably form the commencement of the new record.

The Clarence River series succeeds with its lower members, as at Narrabeen, overlaid somewhat irregularly by the great fluviatile deposits known as the Hawkesbury sandstone (Sydney sandstone of Dana and Jukes), which are thus intercalated in the Clarence River series, and contain *Thinnfeldia odontopteroides*, *Alethopteris Australis*, and *Odontopteris microphylla*, but no *Tæniopteris Daintreei.* Large numbers of Ganoid Fishes, and two or three species of Labyrinthodonts, *Mastodonsaurus* (?) and *Platyceps Wilkinsonii* (P.L.S. N.S.W., 1886) have recently been added to the known fauna of these beds, and, more remarkable still, *Tremanotus Maideni*, a Bellerophontid mollusc, with siphonal openings along the keel, has been described by Mr. Etheridge from Cockatoo Island, where it was found in association with

the thoracic plate of *Mastodonsaurus* (?) determined by myself.* It is an extraordinary instance of survival, but is here especially interesting as proving the estuarine character of at least this stage of the Hawkesbury formation in the Sydney area; a view which I confess seemed to me so inconceivable, in the previous entire absence of marine remains, that I readily accepted this fossil, without examination, as a freshwater mollusc. It is important to remember with regard to these Hawkesbury Sandstones, that they also, at least in the upper portion, offer sufficient evidence of Glacial action, as has been particularly shewn by Mr. Wilkinson, and by Mr. David in a paper on Glacial action in Australia read before the Geological Society, Q.J.G.S., May, 1887, although it does not seem to have met with a very cordial reception. †

I quote again from Mr. Wilkinson: "The surface of the Hawkesbury Formation was denuded and worn into hollows before the Wianamatta beds were deposited." (See also Clarke, Sedimentary Formations, &c., p. 72), "and the latter in their lithological characters show that great physical changes must have taken place, for they consist chiefly of argillaceous shales, which are in striking contrast with the thick bedded arenaceous rocks underlying them. The fine sediment which formed the Wianamatta shales evidently settled down in the quiet waters of a lake." *Thinnfeldia odontopteroides, Alethopteris Currani, Odontopteris microphylla* and *Phyllotheca Australis* continue from the Hawkesbury, but *Macrotæniopteris Wianamattæ* and *Gleichenia* sp., appear as new species. The genus *Palæoniscus* is common to both, and both yield

*This genus, on account of the siphonal openings, has led to the removal of the family from the Heteropoda to " a position near the Fissurellidæ and Haliotidæ, and between these groups and the Pleurotomariidæ."

†In the discussion of this paper Professor Boyd Dawkins is reported to have said that " he had found *Glossopteris* to the west along with Lepidodendroid plants of Mount Victoria." I suppose we should read "*Glossopteris* along with Lepidodendroid plants to the west of Mount Victoria." There is plenty of *Glossopteris*, but if any Lepidodendroid fossil was found there it must have been a lower carboniferous or upper devonian form, possibly from Mount Lambie, or perhaps as a transported and foreign fossil from the upper marine (glacial) beds.

Labyrinthodont remains, but from the Wianamatta Mr. Etheridge (in his report mentioned above) also describes two species of *Unio* and two species of *Unionella.*

It seems a plausible hypothesis that the Upper Clarence Beds may have been more or less contemporary with the Wianamatta Shales. But, in any case, above these Wianamatta or Upper Clarence beds we have no later formation, marine or fresh-water, on the eastern side of the colony,—but on the right bank of the Darling we find the Cretaceous marine beds which are so largely developed in Queensland, and which probably come near the marine beds of Uitenhage in South Africa.

The whole series—as determined from the work of the Rev. W. B. Clarke, Mr. Wilkinson, Mr. David, Mr. Etheridge and the Rev. J. M. Curran, is as follows:—

	Formations.	Climate (Supposed).
	Paroo beds, Marine, Cretaceous....................	(?)
	Break in the Record (?).	
1 (?)	Wianamatta Shales, lacustrine, 700 ft............ Clarence River Upper Coal-Measures, 500 ft. (?)	equable.
2.	Hawkesbury Sandstone, fluviatile, 1000 ft.......	extreme.
3 (?)	Clarence River Lower Coal-Measures, 300 ft. (?). Narrabeen beds....................................	equable.
4.	Lake Macquarie Conglomerate..................... Estheria Shales, Flooded Plains (?), 640 ft........	extreme.
5.	*Break in the Record.*	
6 (?)	Ballimore Coal-Measures........................... Upper or Newcastle Coal-Measures................	equable.
7.	Barren Shales, Floods and Droughts (?), 2000 ft.	extreme.
8.	Middle Coal-Measures..............................	equable.
9.	Upper Marine beds..................................	extreme.
10.	Lower Coal-Measures...............................	equable.
11.	Lower Marine beds..................................	extreme.
12.	*Break in the Record* (?).	
13.	Lepidodendron beds.................................	equable.

QUEENSLAND.

From Mr. Jack's Handbook of the Geology of Queensland, which contains also much of Mr. Daintree's observations, we obtain the following ascertained facts:—

The Lower Carboniferous with its characteristic fossils appears at Gympie. In the Star basin also, at the junction of the Big and Little Star Rivers, tributaries of the Upper Burdekin, we find besides Marine Carboniferous fossils, *Lepidodendron australe*, *Knorria imbricata*, &c., these beds being no doubt identical with the *Lepidodendron* beds of Gloucester, Goonoo Goonoo, &c., N.S.W. The same beds with a similar but better preserved flora occur also in the Drummond Range, which forms the watershed between the Belyando and Mackenzie Rivers, and is intersected by the Central Railway.

Here the Carboniferous Flora ceases, as elsewhere, abruptly, and we find the *Glossopteris* beds of our *Upper Carboniferous* appearing in the Bowen River Coal Field, in which three distinct series of sedimentary rocks are presented. At the base of this formation we find white and red sandstones overlaid by the bedded trappean rocks of Mount Toussaint, Mount Divlin and Mount Macedon. They are succeeded by Series II., chiefly marine, with strong evidence of Glacial action, and *Glossopteris*, and are identified by Mr. Jack with our Lower Coal, and Lower and Upper Marine beds. The Third Series, of freshwater formation, which is represented also at the Oakey Creek (Cooktown), Little River (Palmerville), and the Dawson-Comet-Mackenzie Coalfields, with *Glossopteris Browniana*, *Phyllotheca Australis*, &c., corresponds to our Upper Coal Measures.

In the Burrum Coalfield, extending from the Burnett River to Maryborough, and near Rockhampton, *Glossopteris Browniana*, and *Tæniopteris Daintreei* occur in association, a fact which has been thought to be repeated in the Jerusalem Coalfield of Tasmania; and Mr. Jack observes that "it seems probable we have here a series of passage beds bridging the gap between the Bowen and Ipswich Coalfields." This gap, in which *Glossopteris*

is about leaving the stage and *Tæniopteris* has already appeared, must, one would suppose, correspond in position more or less to the hiatus to which I have already referred between the Newcastle and the Clarence River series.

The Ipswich or Brisbane River coal measures correspond without doubt to the latter (Narrabeen and Clarence River), containing as they do *Tæniopteris Daintreei*, *Cyclopteris cuneata*, *Thinnfeldia odontopteroides*, *Alethopteris Australis*, &c.

But in Queensland this formation *seems* to be continuous with the Cretaceo-jurassic, which we have already met with on the right bank of the Darling, but which is of vast extent a little further north.

There appears to be no break in the continuity of the Ipswich beds with the great Rolling Downs formation, "which contains a marine fauna (and occasionally freshwater) representing the migration of many species which in Europe date from Rhætic to Cretaceous, but which cannot be quoted as arguing a strict contemporaneity of life." (Jack, l.c. p. 67.)

It is not difficult to understand the survival of Triassic forms in these regions, since many such remain to this day. But it is very difficult to imagine that a large number of fossils of Cretaceous character should have appeared in the southern hemisphere so far in advance of the northern as to alter the character of a true Jurassic fauna.

The mode in which these fossils chiefly occur, in nodules lying upon the general surface of the ground, seems to suggest that a considerable erosion of the softer portion of the deposits, has carried away all the mass which once overlaid the present surface, and has left behind it the hard and heavy concretions which had formed around the organic remains of many periods in succession, so that Cre taceous fossils from the highest and first denuded beds are mingled with Jurassic forms from the lower and last denuded. Otherwise we must inevitably be drawn to the conclusion that the *Tæniopteris* flora extended its duration into a period contemporaneous with (at least) the Lower Cretaceous in the Northern Hemisphere. This would bring the Hawkesbury beds with their

Labyrinthodonts, *Tremanotus*, &c., to a period near that of the Upper Jurassic; a position not apparently quite consistent with the fauna; yet it is not an inconceivable solution of the problem.

The succession, as recorded in Queensland, is therefore

Rolling Downs, Marine Lower Cretaceous. = Paroo beds, N. S. W.

1-4.	Upper, Ipswich, &c., Coal-Measures	Upper Clarence R. Hawkesbury, Lower Clarence.
5.	Burrum Coal-Measures.	*Break in the record.*
6-11.	Bowen Coal-Measures, 3rd series	Upper and Middle C.M.
	Bowen Marine, glacial, 2nd series	Upper Marine beds
	Bowen Sandstones, 1st series	Lower C.M., Lower Marine.
12.	*Break in the record.*	
13.	Drummond Range beds, &c. (Lepidodendron flora)...	Stroud beds, &c.

The correspondence with the formations of New South Wales is, as might be expected, clear enough in general outline; and it may be confidently expected that between the two series a fairly complete history of the East Australian Lands during the Carboniferous and Mesozoic periods may be ultimately constructed.

VICTORIA.

The Geology of this Colony has been pretty well worked out in many especially the mining districts; but the Mesozoic beds have received less systematic investigation;—and it is with these that we are here principally concerned. For, with the exception of certain *Lepidodendron* beds upon the river Avon in Gippsland, there is no Carboniferous record whatever in the country; and these ought very likely to be ranked as Devonian. Nor is there even any *Glossopteris* to be quoted, whether Carboniferous or Mesozoic; but the next beds the Avon sandstones—after a

very long interval — are the *Gangamopteris* beds of Bacchus Marsh, which are said to afford unequivocal evidence of Glacial action, and are at the same time probably related in some way or other to the Newcastle Coal Measures which contain both *Gangamopteris* and *Glossopteris*.

These *Gangamopteris* sandstones and glacial conglomerates of Bacchus Marsh, resting partly on strongly folded and denuded Silurians and partly on the older volcanic rocks, have generally been regarded as the equivalents of the Indian Talchirs, which, as stated above, are supposed to be represented by the Ecca glacial conglomerates and *Glossopteris* shales in South Africa; and by the Upper Marine Beds in New South Wales. But Feistmantel with more reason—as it seems to me—places the Bacchus Marsh beds *above* the Upper Coal of N.S.W. (Proc. Roy. Soc. N.S.W., Vol. XIV. 1880, p. 111).

Above these *Gangamopteris* beds of Victoria succeed the Carbonaceous (so called) beds, the last, if not the first, of the Victorian Mesozoic, with two species of *Unio*, three of Cycads, and, more important for our purpose, *Pecopteris* (*Alethopteris*) *Australis*, and *Tæniopteris Daintreei*.

Now these same ferns of the Carbonaceous rocks of Victoria occur also together in the Clarence River beds, so that there can be little doubt of the correctness of their identification, which, indeed, has not to my knowledge been questioned. But the discovery of the Narrabeen beds, and their identification with the lower beds of the Clarence River, involving the claim of the latter to a position intermediate between the uppermost *Glossopteris* beds (*i.e.*, the Newcastle Coal Measures), and the Hawkesbury sandstone alters the argument in some respects. Granting, as we must, the correspondence of the Carbonaceous beds with the Clarence River series, including the Hawkesbury sandstones, we must look for a quite different horizon for the Bacchus Marsh Glacial beds than that mentioned above. The absence of *Glossopteris* in the one case, as compared with its luxuriance and variety in the other, has always presented some difficulty in the way of

accepting the identification of the Bacchus Marsh and Upper Marine Glacial and Boulder beds. It seems to me that the evidence is in favour of Feistmantel's correlation of the Lower Bacchus Marsh beds with the blank space above the Newcastle series, in which case the overlying *Tæniopteris* beds come out directly in their accepted position, equivalents of the Clarence River and Hawkesbury deposits.*

The Victorian series is, therefore, apparently to be rearranged as follows, by an adaptation of the list given in Murray's Geology of Victoria, p. 85.

1, 2, 3.—Carbonaceous rocks of the Wannon, Cape Otway, Western Port, and North Gippsland—Coal Measures and sandstones—corresponding to the Clarence River series with the intercalated Hawkesbury sandstones, which are probably represented by similar fluviatile formations in Victoria, especially in the Cape Otway district.

5.—Bacchus Marsh conglomerates and sandstones with evidence of Glacial action, and with *Gangamopteris*, corresponding to some part of the great blank in the New South Wales record, between the Newcastle Coal Measures and the Lake Macquarie conglomerate.

6-12.—No record of any part of the period which elapsed between the close of the Lepidodendron era in New South Wales (Stroud, &c.,), and the uppermost Newcastle beds; that is to say, of the whole *Glossopteris* period, together with the undefined age of change which immediately preceded it.

13.—Lepidodendron beds on the Avon, Gippsland, corresponding to those of New South Wales.

I should wish to draw particular attention to the Glacial character of the Bacchus Marsh conglomerates, as indicating that

* This was practically Feistmantel's conclusion before the Clarence River beds were removed to their true position, before the discovery of Labyrinthodonts in the Hawkesbury sandstones, and, of course, before Mr. Wilkinson's discovery of the intercalation of the latter formation between the lower and upper members of the Clarence River beds.

the blank period in which the disappearance of the *Glossopteris* flora took place was one of extreme or severe climatic conditions, accompanied by development of Glacial phenomena either generally or under local conditions.

Tasmania.

In Tasmania we find no Lepidodendron beds, nor any other record of upper Devonian or lower Carboniferous. The marine beds of Eastern Tasmania, with *Productus brachythærus*, &c., and evidence of Glacial action (Bruni Island and elsewhere), are classed by Mr. Johnston as equivalents of our Lower Marine series, with which they sufficiently correspond. But the Mersey (or Lower) Coal Measures, with *Glossopteris* (?), *Gangamopteris* and *Noeggerathiopsis spathulata*, etc., seem to correspond rather with our Middle and Upper Coal Measures, than with the Lower or Greta Coal, with which our author correlates them. If so, these Tasmanian "Lower Marine" beds may represent the whole of our Lower Coal Measures and "Marine" beds; and the Mersey Coal Measures, our "Middle and Upper Coal Measures." But the Tasmanian "Upper Coal Measures" are plainly the same as the Clarence River and Ipswich beds, in all of which *Glossopteris*, previously so abundant, disappears for ever. A doubtful case of *G. linearis* and *G. moribunda* is indeed reported from some of these Upper Coal Measures in Tasmania, just as Mr. Jack mentions another species still surviving in the Burrum basin. But otherwise the fossil flora clearly indicates this identification, which extends even as far as South Africa, where the Stormberg beds contain the very same species, as successors to the same species (?) of *Glossopteris*.*

* Since writing the above I have received a note from my brother, Mr. Stephens, M.A., F.G.S., of Hobart, mentioning that a fossil heterocercal Ganoid, probably a species of *Palæoniscus*. though in imperfect preservation, has just been discovered in the Knocklofty Sandstone, belonging to the highest formation of the Upper Palæozoic marine beds in the south of the island. The identification of this fossil will be looked for with some interest. Its occurrence, however, is some evidence in favour of a fluviatile origin for this sandstone, which may possibly, like the Hawkesbury beds, be ultimately relegated to a later period than was originally thought probable.

New Zealand.

In New Zealand the Lower Carboniferous beds have as yet yielded no plant remains. They consist in the lower beds of limestones with characteristic marine fossils, gradually passing upwards into unfossiliferous fine grained argillaceous slates. (Hector, Outline, &c., p. 78.) We are not warranted, it seems to me, in assuming that the Lepidodendroid Flora of the Lower Carboniferous in Australia and Africa ever had existence in New Zealand, although there must have been land surfaces, with some kind of flora.

That those islands were more or less directly connected with Asia and Australia during some part of the Mesozoic period is extremely probable, if not absolutely certain. But there is nothing to indicate any earlier connection on this side, and we are quite certain that there was none in the subsequent ages; though it is probable enough that at more epochs than one New Zealand may have formed an outlying portion of an Antarctic continent.

However this may be, the next in sequence, the Oreti-Kaihiku series, regarded as Permian on the ground of its Molluscan fauna (though containing also Saurian remains (*Ichthyosaurus*) and Labyrinthodont (?) teeth, and remarkable for the "absence of *Spirifera*, *Productus*, and the other usual Palæozoic elements of a Permian fauna," both of which facts appear to indicate a Mesozoic rather than a Palæozoic position, (Hector, lib. cit.), presents, in its lower portion, a glacial conglomerate or boulder formation "resembling the character described for the base of the Gondwana series in India," and above this one species at least of *Glossopteris*. It is impossible to recognise in the marine fauna here quoted (Permian Molluscs and *Ichthyosaurus*) or in the (probably) Labyrinthodont remains, any resemblance to our Upper Marine (Carboniferous) beds, however much they may appear to correspond in their evidence of glacial action.

But let us consider the series which follows. The Wairoa-Otapiri series, with a fauna of very mixed character, combining some surviving Permian forms with a great majority of distinctly Triassic character, and a few which are Jurassic in Europe, has been on the whole regarded as Triassic, the Wairoa beds even as lower Trias. Yet the presence of *Belemnites otapiriensis*, which is near *B. elongatus* of the English Lias, along with *Pleurotomaria ornata* and *Tancredia truncata*, which are "Oolite forms," (Hector l.c. p. 71), must not be neglected. In this formation there are also fresh water beds, with *Glossopteris*, *Zamites*, and *Rhacophyllum*. Now, looked at from the northern standpoint, all our Mesozoic and post-Mesozoic formations appear of a mixed character, like what are called Passage beds in an area of definite formations. And in the same manner the corresponding formations in the northern hemisphere would present to the Antarctic geologist, who had commenced with our Australasian and South African fossils and had studied these alone, a similar confusion and mixture of heterochronous characters. Yet in view of the much more rapid and extensive dispersal of animals, and especially of marine animals, than of plants, and the great preponderance of the Holarctic region in abundance and variety of forms, both vegetable and animal, in view also of the evidence of a general drift of these forms to the southward, at least since the commencement of Mesozoic times, and taking into account the generally feeble character of the return current or remigration towards the Equator, by which some types are creeping north from the now sunken Antarctic continent and its still extant outliers in New Zealand, Tasmania, and Eastern Australia, South Africa and South America, we may come to a general conclusion that a large number of contemporary northern types found fossil in any southern marine formation indicates a nearly synchronous but later period for the southern than for the northern equivalent; so that a Southern Cretaceo-jurassic Fauna should be considered as synchronous with, or even a little younger than the European Cretaceous, and a Liasso-triassic assemblage, on the same principle, as Liassic; except

where there is reason to suppose that the Liassic element is of Southern origin, in which case we should accept the Triassic position.

I should therefore regard the Oreti-Kaihiku as, at any rate, not more ancient than Triassic, and as properly correlated with the Clarence River and Hawkesbury beds, with their Labyrinthodont fossils; and in the same way I should suppose the Wairoa-Otapiri series to extend upwards into the Oolitic period of the northern hemisphere. (See Capt. Hutton, Geol. N.Z., Q.J.G.S., 1885.)

It is true that in both of these series we find the record of *Glossopteris*, a fact which seems to militate against the view here proposed, since in New South Wales this form is undoubtedly Palæozoic, and perhaps truly Carboniferous. But it appears to me that *Glossopteris* must have continued to exist in New Zealand long after its complete disappearance from New South Wales, the region in which it had been present earlier, in greater abundance, and with more numerous species than in any other known part of the Southern Hemisphere. And therefore, disregarding *Glossopteris*, and relying on the presence of Saurian and Amphibian remains, and the absence of *Spirifera* and *Productus*, I cannot but think that the Oreti-Kaihiku comes in above our upper coal, and that the glacial period which the base of this formation records in New Zealand, was the same period which, without leaving any tokens of its presence, and very possibly without any accumulation of ice at all, closed our Upper Carboniferous period by putting an end to the flora characterized by *Glossopteris*, *Vertebraria*, &c. If so, the Clarence River and Hawkesbury formations may together form the equivalent of the combined Oreti-Kaihiku and Wairoa-Otapiri.

The succeeding formations in New Zealand are classed by Sir James Hector as Liassic, Jurassic and Lower Greensand, and represent the Rolling Downs formation and the Uitenhage of S. Africa. Capt. Hutton, however, regards them as *Lower* Jurassic

(l.c. p. 194). Omitting them therefore from our present consideration we shall have a conjectural list of parallel formations made out as follows :—*

	NEW ZEALAND.	NEW SOUTH WALES.
1.	Mataura series, No. VIII., Hector, l.c. "Jurassic" ...	Wianamatta.
	Macrotæniopteris lata ...	*M. Wianamattæ.*
	Tæniopteris Daintreei, Clent Hills, N.Z.	
	Otapiri-Wairoa (No. X.), "Triassic"	Upper Clarence beds.
	Glossopteris, Labyrinthodonts	
2,	Oreti conglomerate—evidence of ice	Hawkesbury beds, Labyrinthodonts.
3.	Kaihiku beds (No. XI.), "Permian"	Lower Clarence beds, Narrabeen, &c.
	Glossopteris, Labyrinthodonts.	
4.	(?)	Conglomerates of Lake Macquarie, &c.
5.	*Break in the record.*	
6-11.	Maitai series, No. XII., "Carboniferous"	Glossopteris beds, Newcastle C.M. to Lower Marine.
	Spirifer bisulcatus, S. glaber, Productus brachythærus, Cyathophyllum, Cyathocrinus.	
12.	*Break in the record.*	
13.	Te Anau beds (No. XIII.), "Devonian" (?)	Lepidodendron beds at Stroud, &c.

If we endeavour to reconstruct for ourselves the varying aspects of the whole region during the vast extent of time over which we have glanced, we shall see some such succession of Physiographical features as the following :—

* See Proc. Roy. Soc. N.S.W. Vol. XIII. 1879, p. 68, for a provisional classification by Sir James Hector, which however, as was inevitable at that time, contains many misapprehensions as to the succession on our side.

First,—we behold an Australian group of islands extending from below the Tropic, and perhaps even from the Asiatic continent, up to an Antarctic Archipelago or continent, which is also approached in like manner by two other oceanic lands; one, a group of islands to the east, representing the present New Zealand, the other, a great way further to the westward, being the southern prolongation of the African continent; but we cannot make out anything of the corresponding extremity of South America.

In all of these are ranges of mountains rising into the clouds above those areas which are marked in geological maps as occupied by the older crystalline rocks, their summits white in many regions with perennial snows, and fostering glaciers in their upper hollows. The lower hills, where they are shaped out of sedimentary rocks, are full of the fossils which we call Silurian or perhaps also Devonian. If we confine our attention to the Eastern portion of the area roughly marked out above, that is to say, Eastern Australia, New Zealand, and the intervening portion of the Pacific, disregarding the larger western part formed by Western Australia, the Indian Ocean and South Africa, but remembering at the same time that both the seas mentioned are practically landlocked towards the south, we shall see that the warm equatorial currents of the Pacific which then as now flowed southwards along the eastern shores of both the eastern and the western islands, and through the various channels which divided each of those groups were not as now confronted, split up and chilled, in or about "the forties," by a vast and continuous flood of cold water from the west, nor by the influx of still colder drifts of iceladen currents from the polar seas, but were defended from both by tracts of land which at the present moment are submerged. The currents flowing from the equatorial regions were thus forced to return along the northern shores of the Antarctic lands, warming them as the Gulf Stream now warms the coast of Norway, and to complete their circle by bathing the western shores also of New Zealand, which thus lay between two currents, one much the warmer, running southwards, the other cooled but

not chilled, flowing to the north. (Somewhat similar to this was the system of circulation in the Western or Indian Ocean, though on a much larger scale.)

Hence the climates were warm and moist, the land surfaces below the snow line were clothed with luxuriant vegetation, and the sea swarmed with animal life of familiar Carboniferous types. The maritime lowlands, especially in the eastern portion of the Australian group, were covered with forests or jungles of Lepidodendra, Calamites, and the other allied forms with which we are so familiar in the Carboniferous formations of the Northern Hemisphere. In the more northerly parts of the same group such forms were abundant on both eastern and western flanks of the principal islands; but towards the south they became more and more restricted to the moister and warmer east. As the land rose towards the mountains the vegetation grew less luxuriant, and began to consist principally or at least most conspicuously of ferns and Equisetaceous plants of humbler growth and hardier habit; until at the higher level the plants became for the most part reduced to ferns of creeping or scrambling habit, with simple fronds not unlike some of the existing Polypodiums, accumulating in thick matted brakes, the lower beds of which were gradually being consolidated into peat.

Among these, especially near brooks or in swamps, were dense reed-beds of Horsetails or similar plants. In short, the flora of these high lands was of what I have already named the Glossopteris type; while the dense and rank vegetation of the shores was the Lepidodendron flora of the Northern Hemisphere, of the Drummond Range, of Tamworth, Stroud, Cobar, Gippsland, Grahamstown in S. Africa, and other places known and unknown. It did not however extend, so far as I can see at this distance, into the latitudes of Tasmania, nor into the New Zealand group to the eastward. This is the first picture in the geological magic lantern, the first of the epochs under our consideration.

After a long interval of darkness in which we can discern nothing clearly, but have an indistinct perception of great

variations in level, vast volcanic disturbances, and consequent geographical alterations, we again begin to see in a glimmering light the landscape as before, but in a strangely altered state. Subsidence of the land or rising of the sea has opened ways for the cold ocean currents from the west, and the still colder water from the icy south. The maritime regions that formerly bore the exuberant jungles of the Lepidodendron flora are now below the sea-level. The climate in general is severe and stormy, modified of course by local conditions. The snow line has descended, and before it the Glossopteris flora has been gradually forced likewise, step by step, to a refuge in the low lands.

Strange as it may seem, it is nevertheless certain that however extreme the transformation of the landscape may have been, the waters of the sea and their inhabitants underwent no sufficient hardship to alter their character. From the last preceding marine fossiliferous beds we find the following genera and species still surviving, viz.: *Cyathophyllum*, *Amplexus*, *Syringopora*, *Favosites*, *Strophalosia*, *Chonetes*, *Orthis*, *Rhynchonella pleurodon*, *Atrypa*, *Spirifer*, *Tellinomya*, *Aviculopecten*, *Pterinea*, *Dentalium*, *Murchisonia verneuiliana*, *Pleurotomaria*, *Euomphalus*, *Loxonema*, *Goniatites*, *Orthoceras* (Report Dep. Mines, pp. 57-67). I have no doubt that this list will be largely increased by further identifications in the older or Devonian beds.

This is our third epoch—that of the Lower Marine beds. In the fourth—the Lower Coal Measures—we see the land again emerging, broad valleys opening upon well-watered plains; a climate, if not warm, at least constantly temperate, moist, and eminently favourable to the growth of the Glossopteris flora, which is now occupying wide areas with the peat mosses which are to be the "Lower Coal" of the future. On the drier elevations we see forests of Araucarias and other conifers. But the snow line is still at a lower level than in the Lepidodendron time, and the glaciers, in consequence of the abundant precipitation of aqueous vapour, descend even lower than in the colder period immediately preceding. Except in the more

northern parts, as before, the western shores of the Australian islands have a drier and colder climate, and a much less abundant growth of the eastern flora. We cannot see what the vegetation of New Zealand is, but conjecture it to be scanty, developed as it must have been from very small remnants of a scanty indigenous flora. Few forms could have survived the severities which had destroyed the Australian Lepidodendra. (For even here in Australia the destruction of species must have been enormous, and the number of survivors very few, as the vast profusion of individuals and fewness of species which is so marked a feature in our Upper and Middle Coal Measures clearly shows. Yet here was a large quasi-continental area, extending far towards the north, on which to draw for replenishment of the recovered land, while New Zealand does not seem *at that time* to have had any advantage of the sort.) The emergence of the land has again barred the channels of the old currents from the west and south, and the genial, or at least equable, climate of the former period has been renewed. Why, then, has not the former vegetation recovered its place? The same plants as flourished here in the reign of the Lepidodendron flora of Australia are flourishing still in jungles as thick and luxuriant as before, in Brazil, and in vast regions of the Northern Hemisphere. Why not, therefore, in Australia also? The answer is simple. The destruction was so complete that it left no Australian asylum in which a remnant might have been preserved for the future restoration of the race. The communication between Australia and Asia was also interrupted, so that re-migration from the northern continent was impossible. Besides, the climate seems to have altered in respect of average temperature. It seems now to be rather cool than warm, though exceedingly equable and favourable to the growth of ferns.

In the Upper Marine beds we observe a repetition of the submergence of land, thereby reopening the cold water channels, lowering the snow line, and stretching out the glaciers downwards even to reach the sea.

Another age of emergence and amelioration produces the Middle Coal Measures, followed in its turn by the severe interval of the Barren shales.

These oscillations, however interesting as indications of the regularity in these southern regions, as also of the alternations of climate which are so remarkably illustrated in the history of the Glacial periods of the north, are of no importance to us at this moment. But the next emergence corresponding with the Upper Coal Measures appears to deserve more particular attention. Not only have all the climatic conditions been altered by the reclosing of the cold water channels, but some kind of communication with the northern continent has been approximately completed. For, in the rivers of this period, flowing through lands covered with the very same vegetation, and in all other respects apparently just the same as the rivers of the preceding coal-forming epochs, there suddenly appears a quite new arrival from the rivers of the north. For *Urosthenes* is a Ganoid fish of the Palæoniscus family, belonging to a genus well-known in the northern Carboniferous, and makes the first appearance of a vertebrate in the Australian freshwaters.

The Ganoids are essentially freshwater fishes, and though they are tolerant of the brackish water of estuaries, and can doubtless make short voyages by sea from one river mouth to another, yet they are incapable of traversing any considerable tract of salt water, as is indeed shown by the geographical distribution of the surviving members of the order. It is a fair conclusion, therefore, that some means of communication had been at last opened between Australia and Asia. There had been, so far as can be seen, no passage of any organic form from the one land to the other since the period of the Lepidodendron flora, which must have originated in either the Northern or Southern Hemisphere, and whose existence in both requires the hypothesis of a line of communication on the Australian as well as on the American side.

It would be audacious to argue that the existence of such a bridge (or stepping-stone) between Australia and Asia indicates a

greater and more extensive emergence of these regions than had occurred in the previous coal-forming periods. Yet the two things are at least not inconsistent, and the hypothesis will help to account for many otherwise inexplicable or difficult points.

Supposing then, since the supposition is allowable as such, that during this Newcastle period the western and eastern groups of islands (Australia and New Zealand) were both at the same time united (by emergence) with the Antarctic lands, and supposing also that the southern extremity of the African continent was in like manner, and at the same time, prolonged to meet a northern extension of the same, we should once again have two Oceanic regions, the sea between Australia and New Zealand on the one side, and the sea between Australia and Africa on the other, practically closed against all cold currents and continually warmed in their higher latitudes by the equatorial currents generated within the tropics. Such conditions would induce for certain the general dispersion along the maritime districts of those elements of the Australian flora and fauna which had been severally developed by one cause or another in such a way as to qualify them for a general occupation of the new territories offered by emergence and for a contest on advantageous terms with the other competitors.

Thus the *Glossopteris* flora spread into the Antarctic lands, among them east and west to New Zealand and South Africa, and perhaps also northwards from Australia across the equator towards India, then an insular tract in processs of emergence, occupied in all probability by a low and feeble flora, and open as India has ever been to the first invader.

It is unnecessary to enter into further detail. The hypothesis is sufficiently stated, but remains as it began, a hypothesis, involving the assumption that the evidence of the existence of *Glossopteris*, &c., in South Africa and New Zealand does not indicate synchronism with the *Glossopteris* series of New South Wales.

The next period in the New South Wales series (the blank in the record, which succeeds to the Newcastle Coal Measures) is again one of extreme change in the flora and on land.

It was in all probability a period of great replacement in the marine fauna also, no record of which, however, is preserved, except in the New Zealand formations; and these, though corresponding more or less, do not at present allow of a precise correlation. There is no positive evidence on this side of any submergence, though it has been strongly suspected on other grounds, and is suggested by the complete and final disappearance of the *Glossopteris* flora from New South Wales, taken together with its subsequent development elsewhere. The severity of some portion of this period is indicated by the Glacial conglomerates of Bacchus Marsh in Victoria, which can not reasonably be referred to any other epoch, and by the similar and probably contemporary characteristics of the Ecca conglomerates in South Africa. The Burrum Coal Measures of Queensland, and perhaps also the Estheria shales and even the Ballimore beds in New South Wales may possibly indicate intervals of more favourable climatic conditions, such as are testified to by unequivocal evidence during the great Glacial age of the north.

It is impossible at present to do more than guess at the (geological) length of this period, during some part of which I take the Bacchus Marsh conglomerates to have been formed. At its conclusion, however, and after these regions had settled down again under a condition of things not unlike that which had preceded, we find a different flora, quite new to this country, occupying the same ground (more or less) as the lost *Glossopteris.* This, which I call the *Tæniopteris* flora, is unanimously declared to be, from the northern standpoint, Jurassic. (If it is derived from the north it is *later*, and if from the south, *earlier* than its nominal era.) It is at any rate undoubtedly Mesozoic. The lowest and the uppermost formations of this period, taken as a whole, seem to indicate emergence or elevation of the land, so that its abundant rivers swept out in rapid descent to the ocean, bearing with them their loads of coarse detritus, and depositing only in flood-time their lighter silt and finer sand upon the surface of the plains through which they ran.

But in the middle of this period (taken as a whole) the pendulum swung back, and an intervening period of depression and refrigeration took place. Vast rivers, swift in their upper courses, and carrying with them into their lower waters enormous volumes of sand, which they, with their diminished fall, were unable any longer to carry through into the ocean, accumulated about their shifting beds the enormous masses of the Hawkesbury sandstone and its southern equivalents.

In this rock we have evidence, not as yet found in the Lower Clarence beds, of the introduction of many Ganoid fishes, of Labyrinthodonts, and of the existence of other forms whose presence seems at present inexplicable. Upon the hypothesis here adopted it would seem probable that the fish and amphibia had really made their way into this region during the preceding period of emergence (period of the Lower Clarence beds), and during the existence of a temporary "bridge" between Australia and S. E. Asia. In the same way one would account for the contemporary introduction of Labyrinthodonts in the New Zealand regions. And I have more than once shown that it is at least not improbable that *Ceratodus* and *Osteoglossum* (besides *Hatteria*) managed to effect their entrance at the same time. After the Hawkesbury interregnum, the restoration of more equable climates, owing probably to yet another emergence of the land, is testified to by the Coal Measures of the Upper Clarence beds, of Ipswich in Queensland, and of Newtown and Jerusalem in Tasmania.

If the formations of this period do really graduate upwards into the Marine Cretaceous beds of the Rolling Downs series, as suggested by Mr. Jack (above, p. 340), we have here before us a complete record of the very uneventful history of this ancient flora of Australia, from the Lower Carboniferous of both hemispheres to the Upper Jurassic of the southern, far poorer and more antique and, as it were, obsolete, than the contemporary flora of the north.

The breaks in the record are but two—one between the Lepidodendron and the Glossopteris flora, the other between the latter and the Tæniopteris.

(To be continued.)

OBSERVATIONS ON THE OVIPOSITION AND HABITS OF CERTAIN AUSTRALIAN BATRACHIANS.

By J. J. Fletcher, M.A., B.Sc.

The object of my remarks is suggested by the following quotation from a paper by Dr. Günther: "Our knowledge of the mode of propagation of extra-European Batrachians is restricted to a very small number of species; and from the few singular facts with which we have become acquainted, we may expect that most interesting discoveries will be made by naturalists who have the opportunity of observing these animals in their native countries." *

The late Mr. Krefft at different times published three lists of Australian Frogs,† and one of those found in the neighbourhood of Sydney;‡ several of these—as well as a paper "On the Vertebrated Animals of the Lower Murray" &c.§—contain particulars about the habits of Australian frogs, and in one or two of them the subject of their breeding is incidentally but very briefly touched upon. Dr. Günther has also recorded some observations || on four species of Australian frogs—three of which are figured—which lived for some time in the Zoological Gardens, London; and Professor McCoy ¶ has some remarks on *Hyla*

* Ann. Mag. Nat. Hist. 1876 (4), XVII, p. 377.

† (1) Cat. of Nat. and Indust. Products of N.S.W. forwarded to the Paris Universal Exhib. of 1867, p. 107.

(2) Monthly Not. of Pap. and Proc. Roy. Soc. of Tasmania, 1865, p. 16.

(3) "Australian Vertebrata." *The Industrial Progress of N.S.W., being a Report of the Intercolonial Exhibition of* 1870, *at Sydney, p.* 741.

‡ P.Z.S. 1863, p. 386.

§ Trans. Phil. Soc. of N.S.W. 1862-65, p. 32.

|| P.Z.S. 1863, p. 249.

¶ Prodromus of the Zoology of Victoria, Decades V and VI, pl. 42 and 53.

aurea, Limnodynastes dorsalis, and *L. tasmaniensis* to accompany coloured plates of these species. These, together with the notes of Messrs. Aitken and Sanger (*infra* p. 361) I believe, comprise all but what relate to the taxonomy of Australian Batrachians.

The species of frogs referred to in what follows are, with one exception, comprised in the Batrachian fauna of the neighbourhood of Sydney, or, as it would be better to say, of the County of Cumberland, a district which, with an average rainfall of 50 inches, is, for Australia, one very favourable to Batrachian life. It is necessary to point this out because Australia presents such a wide range of climate, and many of the species are more or less cosmopolitan; hence it may be that individuals of the same species may present differences in habits according to locality and variations in external conditions, and more particularly rainfall.

Reference to Boulenger's "Catalogue of the Batrachia Salientia in the British Museum" (1882) shows about fifty species to be therein recorded from Australia and Tasmania, while last year the same gentleman described two additional species; of these New South Wales may be credited with about thirty, and the County of Cumberland with about twenty. This number suffices to show how rich in Batrachians the neighbourhood of Sydney is, though owing to the steadily increasing area required for settlement, the consequent removal of sheltering logs and stones, the contamination of the ponds and creeks with sewage, and the increasing numbers of ducks, geese, and small boys, the collector of frogs already has to lament the devastation of some of the best collecting grounds in the neighbourhood. Though other local lists are not so far available, yet as many of the species are more or less cosmopolitan, and each of the colonies has one or more peculiar species, Australians may well be astonished at the following ridiculous statement, more especially as it is made by so eminent a scientific man as the late Paul Bert: "In our country the poor toads are often cruelly and stupidly destroyed. It will undoubtedly not a little astonish you to hear that great

numbers of these useful but disregarded creatures are sent from Europe to Australia to help to keep the gardens free from noxious and destructive guests, such as snails, insects, &c."*

Of the frogs occurring in this neighbourhood then I have at different times found pairs referable to about ten species *in coitu*, and in most cases have been able to identify the ova, and to determine the circumstances under which oviposition takes place. The species referred to are *Limnodynastes tasmaniensis*, *L. dorsalis*, *Crinia signifera*, *Hyla aurea*, *H. ewingii* var. *calliscelis*, *H. phyllochroa*, *H. citropus*, *Hyperolia marmorata*, *Pseudophryne australis*, and *P. bibronii*. With the exception of the two species of *Pseudophryne* (and perhaps, though I doubt it, also *Hyperolia marmorata*, of which I have seen the ova, but only when laid under abnormal conditions) these come under Section A. of Group I of Mr. Boulenger's Synoptic Table,† that is to say:—

i. "The ovum is small and the larva leaves it in a comparatively early embryonic condition."

A. "The ova are laid in water."

"Probably the majority of Batrachians; all European forms except *Alytes*."

In regard to some of the remaining species, by noting the dates on which males with breeding papillæ have been found, or young ones completing their metamorphoses, some idea of the breeding season has been gained; while the occurrence of recognisable tadpoles in ponds which one has been regularly in the habit of visiting, together with a knowledge of the characters of such ponds and of the facilities which they offer to frogs for depositing ova, enable one to form opinions which will probably eventually be found to approximate to the truth. Hence from such incomplete observations as I have been able to make I think that by far the majority of the remaining species occurring in the County of Cumberland also deposit their ova in water in the ordinary

* "First Year of Scientific Knowledge." By Paul Bert. English Edition translated by Madame Bert (1886), p. 61.

† Ann. Mag. Nat. Hist. 1886 (5), XVII, p. 463.

way without presenting anything remarkable. At any rate, with the exception of the ova of the two species of *Pseudophryne* above-mentioned, no spawn has been met with by me except such as has the characters mentioned. In the case of a few of the rarer species, or those which do not occur very near Sydney, *e.g.*, *Hyla latopalmata*, *H. lesueurii*, *H. dentata*, *Hylella bicolor*, no data whatever have so far been obtained.

The two species of *Pseudophryne* do not oviposit in water, but under stones, &c., in damp situations. The tadpoles, though capable of sustaining without injury a prolonged postponement of the hatching—in one case for a period of over three months,—seem unable to complete their metamorphoses without gaining access to water. These two species therefore are referable to Group II of Mr. Boulenger's Table, and will be provided for if Section A of it be subdivided as follows :—

ii. "The yolk-sac is very large, and the young undergoes the whole or part of the metamorphosis within the egg; at any rate the larva does not assume an independent existence until after the loss of the external gills."

A. "The ova are deposited in damp situations or on leaves."

(a) The embryo leaves the egg in the tadpole stage.

Pseudophryne australis, Gr.; *P. bibronii*, Gthr.

(b) "The embryo leaves the egg in the perfect air-breathing form."

"*Rana opisthodon*, Blgr.; *Hylodes martinicensis*, D. & B."

Other Australian frogs, more particularly *Myobatrachus gouldii*, Gr., (sp.) from West, and *Notaden bennettii*, Gthr., from East Australia, perhaps also *Helioporus albopunctatus*, Gr., may be expected to exhibit similar or perhaps even more interesting modifications. In his description of the first-mentioned of these Dr. Günther alludes to the large size and the fewness of the ova.* *Notaden* is an inland form, recorded in the British Museum Catalogue from Castlereagh River, also from Wilson's River, Queensland; but this species also occurs in the Cobar and Narrabri districts, the

*"The eggs are very large, half the size of a pea, and there are only twenty to twenty-four in one ovarium; no sign of an embryo is visible therein, although the eggs appear to be ripe for being laid." (*Cat. of Batr. Sal. in the Brit. Mus.*, first edition, p. 54).

former of which has (for a period of six years) a mean annual rainfall of 13·66 inches, and 45 as the mean annual number of rainy days, as compared with 49·86 inches and 153 days respectively for Sydney (for 29 years).* Hence in such a locality as this the frogs must sometimes be in great straits to get rid of their ova, if their oviposition is of the ordinary character; and the young must often develop under difficulties unless there is some adaptation to circumstances. Dr. Günther (l.c. p. 378) also says: "The observation of A. W. Aitken (*Trans. New Zeal. Inst.* ii. 1870, p. 87) that in tropical parts of Australia certain frogs form a hollow ball of clay, containing about half a pint of clear cold water, in which they sojourn during the drought, is probably also indicative of a provision to secure the safety of the spawn and young." Further information about this species as well as its identification are desirable. Mr. E. B. Sanger states† that on one occasion he found in pools collected from rain which had fallen two days previously, "the first time for certainly two years," on the stony plains of the central Australian desert, a great number of tadpoles and a young fish; and as to how they came there he concludes "that the eggs must have been buried rather deeply, and then when the moisture reached them developed rapidly." On this subject Mr. Aitken also says (l.c.) "There are districts often exceeding 5,000 square miles in extent in the interior of the Australian continent in which there is no surface water for many months, and in some instances for years; yet as soon as rain falls in sufficient quantities to fill the water-holes they are swarming with young frogs." Further on he again speaks of swarms of tadpoles peopling the water-holes after rain.

Since 1881 I have carefully made notes of the dates at, and the circumstances under which, I have met with frogs breeding; with the result that, taking one year with another for several years, *e.g.* the three years 1884-86, some frog-spawn was met with in every month in the calendar. Not that there was anything abnormal about these years, for a similar result would be quite normally obtainable by regularly collating one's observations for

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* "Rain and River Observations, 1887, p. 41."

† American Naturalist, 1883, XVII. p. 1185.

a longer or shorter period. This interesting state of things—in correspondence with which the creeks and ponds, except of course during such unfavourable seasons as we have recently had when these have had little or no chance of becoming established, may be found more or less teeming with tadpoles throughout the year—is attributable to at least three or four causes:—(1) Dependence of the oviposition on the rainfall, itself irregular; (2) Seasonal differences in the breeding times of different species; (3) The prolongation of the breeding seasons owing to the fact that all the females of a given species may be far from simultaneously ready to spawn at a given time; and possibly (4) some species may breed normally more than once during the year. The mild climate is perhaps also a factor which should not be entirely overlooked.

The rainfall is a most important factor in regulating the dates of oviposition, inasmuch as a heavy downpour of rain is often necessary to release the frogs from their æstivation, and in many cases to provide the water-supply in which the spawn is to be deposited. A heavy downpour of rain succeeding a period of dry weather will set some frogs spawning at any time of the year; and on the other hand, in whatever month the frogs spawn, as a general rule they do so as soon as the weather clears up after rain. In the case of the swamp frogs, if, as in very favourable years, the ponds are full when the frogs are ready to spawn, no doubt they do so; but in very dry seasons they are in the same plight as the less aquatic species.

In England *Rana temporaria* spawns with considerable regularity at the end of February or beginning of March, the spawning lasting about a fortnight; while on the continent two varieties of *R. esculenta* spawn within a fortnight of each other, a fact which is held to be of importance as indicating that they are distinct races, and in maintaining their distinctness.* Similar regularity has been noted in the case of American frogs.† With our frogs there is much irregularity, and the ovipositing periods, instead of

* P.Z.S. 1885, p. 670.

† Packard's "Zoology" pp. 484-487.

being brief and well-marked, are more or less prolonged and intermittent, a condition for which the irregular character of the rainfall is primarily and mainly responsible. Of a period of thirty years the Government Astronomer says:—"There is not much difference in the average amount of rain falling in each of the first seven months, but a marked decrease is manifested in the last five, especially September, November, and December. . . . It is remarkable that during that period every month in the calendar, except December, has been the maximum for the year one or more times. . . . The evaporation in October, November, December, and January is greater than in the other eight months of the year." (Meteorology of N.S.W. Industrial Progress of N.S.W., 1871, pp. 589, 590).

That is to say at the season of the year at which it would seem most natural for the frogs to spawn, judging from the habits of frogs in general, the meteorological conditions on the whole are against them, for, even allowing for averages, the monthly rainfall is decreasing, the evaporation is on the increase, so that spring-droughts are by no means uncommon; this state of things is varied occasionally by a very heavy rain-storm during this period giving the maximum monthly rainfall for the year, an event which gives the frogs special opportunity.

In the case of *Rana temporaria*, for example, all the surviving frogs of the same season's hatching are approximately of the same age, while all the frogs of different ages differ in regard to the same by some multiple of one year. With our frogs this may obviously not be the case, since individuals of the same species hatched during the same season may differ in age by as much as six months or more; so that it is reasonable to expect that the maturation of the ova, though probably occurring at regular periods, should not be simultaneous in all the females of a given species. Consequently of our frogs it may be said that they spawn when they are ready, or as nearly as the conditions of moisture will allow; but that they are not all ready at the same time.

In correspondence with this one never sees as much spawn at any one time as may be seen in an English pond when the frogs are breeding. My most instructive round in one of the suburbs of Sydney included a visit to an old quarry, a brick-yard, a deserted tan-yard, and three waterholes in paddocks used for watering cattle; these five spots were frequented during some period of the year by at least eleven species of frogs. If during a visit to these on the same afternoon in the whole of the ponds together between 100 and 200 individual deposits of spawn could be counted, I should consider it a very brisk outburst of spawning. And one might make this same round after every heavy downpour of rain throughout the year and find more or less spawn as described. But for the "gallons of jelly" which may be seen in English and American ponds* when the frogs are breeding, one looks in vain out here.

There are also indications of seasonal differences in the breeding periods of different species, respecting which further details are given later on.

Mr. Krefft says: "During the breeding season, however (about November), many otherwise nocturnal frogs may be seen in broad daylight in search of their mates. . . . . The greater number of species have deposited their ova in the beginning of December, though I have reason to believe that some species breed at all seasons, for I have taken *Pseudophryne australis* in mid-winter full of ova, and have observed larvæ of this and of several other species in pools of water about the same time. All the Hylidæ, however, deposit their ova only once a year, generally in November and December" (l.c. No. 2, p. 19). On the whole the breeding period is shorter and perhaps better marked in the majority of the Hylidæ which may be said to spawn during the latter half of spring, and summer, certainly both earlier and later than Mr. Krefft mentions; *Hyla ewingii* var. *calliscelis*, on the other hand, is a remarkable exception. As far as my observation goes, *Pseudophryne australis* may be fairly said to spawn during summer, and

* "Wake Robin," by John Burroughs, (English edition) p. 181.

P. bibronii during autumn. Whether some species do not also spawn more than once in the year is very probable, but it is a difficult matter to decide. If this is not the case with some of them then these might almost be said to " breed at all seasons." The species of *Limnodynastes*, however, should be excluded, as though their breeding season is long enough to give them the opportunity of spawning at least once in half-a-year, yet there is a well-marked though perhaps not very long period in winter (say two months or longer or shorter according to circumstances) during which heavy rain neither sets them croaking nor breeding, though in the interval *Crinia signifera*, and *Hyla ewingii* var. *calliscelis* may be breeding and lustily vocal.

Characters of the spawn.—All the spawn observed by me has been (1) white frothy-looking more or less circular floating patches, larger or smaller according to the species, deposited in the water; or (2) small submerged bunches of ova enclosed in clear transparent jelly attached to blades of grass or reeds, or twigs of dead branches, or (3) numerous separate ova not laid in the water but under stones, or débris in reed or grass tussocks on the edges of pools.

The first section includes the spawn deposited by *Limnodynastes tasmaniensis*, *L. peronii*, *L. dorsalis*, and *Hyla aurea;* probably also that of *H. citropus*, *H. cœrulea*, *H. peronii*, *H. freycineti* and others. The floating patches when fresh are more or less circular if free, isolated or often in corners or behind a particularly good bit of shelter the spawn of a few contiguous spawning couples accidentally coalescent, conspicuous from the white colour, and look very much like the froth of soap-suds. If there is no wind they may continue to float freely; otherwise they become adherent to the bank, or anything else with which they come in contact, by the sticky and tenacious gelatinous substance enclosing the ova, or they may have become so from the first where laid. *Limnodynastes tasmaniensis* is very fond of spawning in ditches close to the bank under overhanging ledges. Sometimes the ova are deposited in the middle of a bunch of reeds or grass to which the patches are anchored from the first, or about the bases of tussocks; in many

cases the surface of the water being lowered subsequently by evaporation or otherwise, such patches may soon be left high and dry with little chance of developing. The frothy appearance of the patches is caused by the entanglement of numerous bubbles of air or gas in the glairy envelopes of the ova, and their accumulation on the surface, quite obscuring the ova which to the number of several hundred lie below. The oviposition of the common European frogs is said to take place at the bottom of the water, the ova being subsequently floated to the surface by the disengagement of gas in the substance of the glairy envelopes (the hatching in England not taking place for a month). The frothy appearance of the spawn of our frogs is hardly I think to be explained in this way. In shallow pools they may be said to oviposit at the bottom of the water—and in many cases, though it may be only accidental, it seems as if the frogs preferred to oviposit in shallow water an inch or two in depth, *e.g.*, in rain pools, or in a chain of little pools along the course of overflow of a pond, or in the water-tables of roads, and which often dry up in a few days' time without the tadpoles having a chance of surviving, and this though more permanent supplies of water may be close at hand; or round the edges of large ponds. But on the other hand, whether from choice or necessity, frogs certainly do spawn sometimes in deeper water, and then the copulating frogs may be seen floating at the surface, or clinging to the branches of partially submerged shrubs, and they evidently spawn so. Moreover such frothy patches enclosing the still segmenting ova, and sticky enough to adhere readily to anything stationary with which they may come in contact, may be found floating freely; and by visiting a pond in the evening and then again in the early morning, one may satisfy oneself as to some of its having been deposited during the preceding night, even if one cannot get more direct evidence. Hence it seems to me that the buoyancy of the patches is possibly quite as much dependent on the entanglement of air-bubbles due to oviposition at or close to the surface of the water, or perhaps to some peculiarity in the mode of oviposition, as to the liberation of gases by decomposition in so short a period, more especially as in our mild climate the tadpoles are hatched by

about the fourth or fifth day (longer if the weather is very cool), the patches in the meantime spreading out and becoming larger but losing their frothy appearance and showing signs of disintegration. The spawn referred to the next section also is without the frothy character, even when not attached to twigs &c. as sometimes accidentally happens. At the same time it must also be pointed out that in all the cases in which *L. tasmaniensis*, and *H. aurea* spawned in dishes of water in captivity the spawn was without the frothy appearance; but the very unnatural conditions of the surroundings and circumstances probably will explain this.

Such spawn may be found intermittently from about the middle of July to the following April or May, sparingly at the beginning and end of the season. If the conditions are favourable a good deal of spawn may be met with in August, and again towards the end of September or beginning of October or thereabouts; if however there is a spring drought then vigorous spawning may be looked for about the middle of January, when heavy showers accompanying thunderstorms may be expected. The ova are small and numerous, and so far as I have seen have the pigmented pole very dark, dark brown or blackish or even black, the unpigmented portion being white or whitish, or slightly tinged with a dark wash, about 1-1·5mm. in diameter.

The second section includes the spawn of *Crinia signifera*, *Hyla ewingii* var. *calliscelis*, and *H. phyllochroa*; probably also *H. krefftii* and other small species. This kind of spawn in inconspicuous bunches of 1-2 inches long is symmetrically disposed round grass- or reed-stalks or twigs, so that the spawn remains submerged just below the surface of the water, very much as described in certain American species. There are about 100 ova in a bunch, enclosed in clear jelly; and from the small number of ova, and the slender nature of the supports, one would expect them to have been deposited by small frogs. The ova of *Crinia signifera* have the pigmented pole black, the rest of the ovum being white; of *C. ewingii* var. *calliscelis* orange and pale

yellowish; and of *H. phyllochroa* yellow, the lower pole slightly tinged with yellow. Exceptionally one may see this kind of spawn floating free, or attached otherwise than as described; but this is probably accidental or due to the absence of grass-stalks or twigs. The spawn of this section may be met with under favourable conditions at almost any time of the year; even in mid-winter.

The third section includes the spawn of *Pseudophryne australis* and *P. bibronii*, already referred to, which may be found during summer and autumn. (For further details see p. 376.)

During copulation the males in some species clasp under the arms, in others round the waist; thus the embrace is axillary in *Mixophyes fasciolatus*, *H. aurea*, *H. citropus*, *H. ewingii* var. *calliscelis*, *H. phyllochroa*, and *H. cœrulea*; it is inguinal in *Limnodynastes tasmaniensis*, *Hyperolia marmorata*, *Crinia signifera*, *Pseudophryne australis*, and *P. bibronii*. In a footnote to his description of *Limnodynastes ornatus* Mr. Boulenger says (l.c. p. 262) "that one of the females of this species has on the breast two cicatrices which are evidently caused by the thumbs of the male; this proves that the male seizes the female under the axillæ and not round the waist." In *L. tasmaniensis*, as I have had ample opportunity of observing, the embrace is inguinal as stated above. I have had only a single and early opportunity of observing the *coitus* in *L. dorsalis* and *L. peronii*, when I was not sufficiently alive to the desirability of noting the mode of embrace, and I regret to say that I have never had the chance since of repeating the observation; hence I am unable to speak with confidence in the case of these two species.

The tadpoles of the different species in their earlier stages offer few characters sufficient for their identification—unless perhaps a study of those of the mouth with its horny fringes would yield such. As the completion of the metamorphosis approaches, however, the determination becomes less difficult, the characters of the webbing, or of the metatarsal tubercles, or of the disks when the hind limbs have developed, being among the earliest satisfactorily recognisable

characters. The tadpoles of *H. aurea* and *H. cærulea,* at any rate in their later stages, are green, in the case of the former the larval frogs acquiring golden streaks before leaving the water. I have no definite information as to the length of time which elapses under favourable conditions between the hatching and the completion of the metamorphosis in the case of any species.

For some three months commencing about May, or for a period longer or shorter, or commencing or ending earlier or later, according as the weather is very mild and the season favourable or otherwise, the frogs, like the snakes and lizards, resort to the shelter of logs and stones, under which they are then to be met with in a more or less sleepy condition. It is also noticeable how frequently frogs which at other seasons frequent gullies or swamps, are at this time found on high ground, on the slopes or summits of the ridges, and long distances from water. In this mild climate where the ground is never frozen the hibernation does not seem to be of the thorough-going character exhibited by frogs in Europe and America, which are said to bury themselves in the mud at the bottom of pools, lying clustered together in a state of complete torpidity.* Australian frogs may also hibernate in this way *(L. dorsalis* possibly; Mr. Krefft says also many individuals of *H. aurea);* but seeing how abundant they are in the situations indicated during this period as compared with other seasons of the year, it is evident at least that the habit is by no means universal; and moreover some species like *Hyperolia marmorata* one rarely sees during the rest of the year. Semper in his "Animal Life" (p. 426, Note 36) quotes Forel's view "that winter-sleep does not depend at all on the diminished temperature in winter, but rather on influences determined by food." How far the hibernation of our frogs is due to chill-coma, and how far to scarcity of food I am not

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* Article "Frog," Encyclo. Britann. IX, 794. On the subject of the hibernation of American frogs *vide* Butler in Report Amer. Assoc. Advanc. of Sc. XXXIII, p. 545. and Amer. Nat. 1885, p. 37.

prepared to say; but seeing that some of the small frogs actually breed in mid-winter, one cannot help wondering whether if food were more abundant during the cold months, the period of hibernation would be as well-marked as it is. Certainly the species differ among themselves in certain respects. For example the larger species are silent during this period, but as early about the middle of July if the weather is mild *Limnodynastes tasmaniensis* may be heard and be found to be breeding, whereas this will not be the case with *Hyla aurea* until about the end of September, or a little later, and later still for *H. cœrulea* and *H. peronii*. On the other hand *H. ewingii* var. *calliscelis*, and *Crinia signifera* may be heard croaking and even breeding after rain in mid-winter, though these species are to be found apparently sheltering under stones, &c., like the others.

That our frogs æstivate during hot and very dry periods there can be no doubt; in many cases they must certainly otherwise perish. During such times one hears no croaking and sees very little or nothing of the frogs; while logs and stones no longer afford sufficiently moist shelter. In March 1885, a very dry month, after just sufficient rain to moisten the ground, hearing croaks emanating from what under more favourable conditions is the bed of a pond, I turned up the soil with a stick and soon unearthed half a dozen specimens of *Pseudophryne bibronii*, which were in this manner trying to survive the drought.

Speaking of the Batrachia of Victoria, Professor McCoy says "with the exception of the common green frog *(Ranhyla aurea)* [they] are rarely seen or heard,—the true tree-frogs *(Hyla)* inhabiting the lofty gum-trees, and the *Limnodynastes tasmanicus*, *L. dorsalis*, and *L. affinis* burrowing in the sand during the day."* This statement will not apply to the Batrachians of this neighbourhood except perhaps during a drought. It is quite true that nocturnal frogs like the species of *Limnodynastes* and *Pseudophryne* are not seen or heard in the day-time except when breed-

* Ann. Mag. Nat. Hist. (3) xx, 1867, p. 182.

ing; but besides *H. aurea*, one may see *H. freycineti*, *H. latopalmata*, *H. phyllochroa*, *H. lesueurii*, *H. citropus*, and *Mixophyes fasciolatus* abroad by day, and *H. cœrulea* frequently comes into verandahs and even indoors in the summer evenings: while as for hearing the frogs, in the evenings in October and later after rain in the western suburbs of Sydney wherever there are paddocks and waterholes, one may hear the croaking of individuals belonging to at least half-a-dozen species in the course of as many minutes; indeed the frogs of some species may be heard at any time of year in moist weather. *L. dorsalis* is rarely seen probably owing to its habit of burrowing which I believe Professor McCoy was the first to point out; but *L. tasmaniensis* and *L. peronii* are so commonly to be found sheltering under logs and stones that, except during periods of æstivation, one may doubt whether in this locality they habitually burrow. With regard to the statement that the true Hylas inhabit the lofty gum-trees—a similar supposition in regard to *H. citropus* in the summer being made by Mr. Krefft—one may remark that no evidence in favour of it is adduced in either case; indeed direct evidence would be very difficult to obtain. The most arboreal of the Hylidæ in this neighbourhood may be found on the ground during the cold months, and during the summer they come to the ground to breed, as they doubtless do also to æstivate. It is quite true that Hylas may often be found sheltering under the loose bark on the trunks of trees, but there is no other evidence forthcoming at present of the frogs in this neighbourhood habitually inhabiting lofty trees unless it be that some of them are not so frequently met with during part of the year. Professor Cope remarks of our Hylidæ "that in the latter country (Australia) with its usual perverseness they are terrestrial in their habits."* I think it would not be an altogether unreasonable supposition that the addiction to terrestrial habits, which more particularly characterises the species formerly included in *Litoria*—now along with *Pelodryas* merged in *Hyla* by Boulenger—is to be explained as in part due to the frequently arising necessity of finding more

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* Nat. Hist. Rev. 1865, p. 109.

moist shelter during very dry periods than could be found under loose bark, &c., on trees. On the other hand, *Hyla aurea* which is pre-eminently a swamp frog, may often be seen basking on the trunks or branches of trees which have fallen into or across ponds; while in other situations it is still more arboreal. In Mr. Macleay's bush-house there are generally some of these frogs, which may often be seen perched on the tree-ferns or plants. In March, 1887, Mr. Masters called my attention to a still better instance in which several of the frogs were perched in the asparagus plants preying on the caterpillars and grasshoppers with which at this time of year the asparagus is much infested.

MIXOPHYES FASCIOLATUS, Gthr., is not yet recorded from the County of Cumberland, but it may still be looked for on the side adjoining Illawarra. I am able to record its occurrence at Springwood, and Mt. Wilson, Blue Mts., whereas it was previously known from Clarence River, and Illawarra N.S.W., and Pine Mt. Queensland. From the observation of a single specimen living in captivity Mr. Krefft supposed "that this frog is remarkably fond of lying buried under moss in water, never making its appearance before dark."* Where I have seen it, it is a diurnal frog haunting the banks of creeks in deep shady gullies. It takes readily to the water on being pursued. With an exception or two all my specimens were met with in the open in this way. Two males taken in December, and one in the beginning of April show a large brownish rugosity on the first finger of each hand together with a slight modification on the inner half of each second finger. At the end of December at Mt. Wilson large dark-coloured tadpoles were very numerous in the creeks in the gullies where the frogs were abundant; one of these in spirit with the hind legs about half developed is 61 mm. long including the tail (which is 41 mm.), the breadth of the body being 14 mm. In the beginning of November in the succeeding year the tadpoles were nothing like so noticeably numerous. On April 2, 1888, on opening the tin in which three living specimens of the frogs were brought down alive

* Monthly Notices of Paper and Proceedings Roy. Soc. Tasm. 1865, p. 19.

from Springwood, one male was found to have seized a female, the clasp being axillary; but nothing came of it. Two half-grown specimens obtained at Mt. Wilson at the end of December are 28 and 30 mm. from snout to vent; a third specimen from Springwood at the end of March is 24 mm. These are probably specimens of two seasons' growth. On the whole I should conclude that this species breeds during the summer months and oviposits in water in the ordinary manner.

Mr. Krefft estimated the number of species occurring in the neighbourhood of Sydney as nineteen or twenty, of which in two papers he enumerates seventeen, the others being then undetermined. The thorough revision of the whole group by Mr. Boulenger has rendered Mr. Krefft's lists obsolete, some of the species being now known by different names. It may be convenient therefore to have a revised list of the species occurring in the County of Cumberland, since out of Sydney the opportunities of consulting the British Museum Catalogue are limited. It includes all the species mentioned in the last-named work from the district in question.

Of the following species I have myself collected specimens belonging to eighteen species within the limits of the County of Cumberland, in addition to three others, one (*Hyla lesueurii*) just on the border as well as in the adjacent County of Cook, and two others (*Mixophyes fasciolatus*, and *Cryptotis brevis*) also in the latter county. For the identification of many of my specimens, including all those difficult to determine from mere descriptions, I am indebted to Mr. G. A. Boulenger of the British Museum, to whose courtesy and help I am glad of this opportunity of acknowledging my indebtedness.

CYSTIGNATHIDÆ.

1. Limnodynastes peronii, D. & B., sp.

Not quite so common as some of the others, and not occurring sufficiently near me to be so conveniently and systematically observed. I have seen breeding specimens only once, in February,

in deep water and out of reach in a quarry. At Burrawang it is the common *Limnodynastes* of the neighbourhood, and I have found numbers hibernating under logs in July, some of them females distended with ova as if the breeding season were not far off. It is quite common to find the very young frogs with bright red or carmine longitudinal stripes on the back, corresponding with the light stripes of the adult, and also on the arms and legs. A spirit specimen 22 mm. from snout to vent still shows them well.

2. LIMNODYNASTES SALMINII, Steind.

Keferstein gives Sydney as a locality for this species; Boulenger's Catalogue also for one half-grown specimen. I have never been able to find it, nor are there specimens of it from nearer than Bathurst in the Macleay Museum

3. LIMNODYNASTES TASMANIENSIS, Gthr.

One of our commonest frogs, and about the earliest of the larger species to be heard croaking and to be found breeding after hibernation, as it is about the last to leave off before this period. A female taken *in coitu* on January 30th spawned the following day; she had a light vertebral line, the male had not. The tadpoles must be very common, but I do not happen to have met with them at a stage of growth in which they were identifiable. As Mr. Krefft observes, the very young frogs often show a distinctly red vertebral line.

4. LIMNODYNASTES DORSALIS, Gr., sp.

Probably not rare, but it manages to keep out of sight, possibly owing to its penchant for burrowing. I have seen one pair *in coitu* late in September; guided by the croak I captured a male in November with well-developed breeding rugosities—a pair on each hand; in February I found three dead ones (probably stoned by boys) with frothy spawn in a pond at Manly; and I have seen a male captured in March, also with breeding rugosities. The breeding season is thus possibly as prolonged as in *L. tasmaniensis*.

The tadpoles are very large—the largest occurring in the neighbourhood. I have seen them in ponds at least as late as June and as early as September. Several which I have measured are from $2\frac{1}{2}$ to nearly 3 inches long, the tail about half as long again as the body. At first they are very dark in colour, almost blackish, but they become lighter as they increase in size, the ground colour becoming brown or olive-brown much spotted with darker spots; they have a single spiraculum on the left side of the body. Two larval frogs with the tail all but absorbed are about 21 mm. from snout to vent. Neither the tadpoles nor the frogs seem to show any of the carmine spots or stripes so commonly present at some stage in other species of the genus.*

5. Crinia georgiana, Bibr., sp.

I have never met with this species which ought to be easily recognisable by its having the "loins, front and hinder side of thighs and inner side of tibiæ carmine." Mr. Krefft mentions it only in the latest of the four papers referred to, and then as from King George's Scund, not from Sydney. The latter is given by Dr. Günther (*Ann. Mag. N. H.* (3) xx, p. 53) and in the British Museum Catalogue.

6. Crinia signifera, Gir. sp.

One of our commonest species. At Burrawang late in June after three days' incessant rain during which as many inches fell, hundreds of these tiny frogs in the swamps and creeks began to croak. One much distended female had the oviducts crammed with ova. A few mornings after I found at least fifty deposits of similar ova attached to blades of grass and reeds in a small pond though except on cloudy nights there were sharp frosts and the surface of the pond was frozen over in the mornings. A fortnight later at Capertee (2700 feet) in equally cold weather

* In the young frogs of *L. tasmaniensis* and *L. peronii* as mentioned above; in the adults, probably also in the young, of *L. salminii* and *L. fletcheri*, Blg.; and in the young frogs, and, as I have also reason to think, in the advanced tadpoles of *L. ornatus*.

similar spawn was noticed. About Sydney I have met with it in different years in February, May, and July.

At Mt. Wilson at the end of December I found a pair *in coitu* under a stone near the water. Possibly this species breeds more than once a year.

7. Hyperolia marmorata, Gr., sp.

Common under stones in the cool months. Females distended with ova may be found in June; once early in June a day or two after bringing home some specimens three were observed *in coitu*, a second male clasping the first; of a number of specimens kept in confinement for two months (July and August) two on one occasion in August were noticed *in coitu*, but no ova were deposited in either case. Of three specimens kept for some days in September one female deposited over 200 separate ova in a dry saucer, but they did not develop and probably had not been fertilised. The ova had the pigmented pole black, the other cream-coloured.

8. Heliophorus albopunctatus, Gr.

Sydney is mentioned as a locality by both Boulenger and Keferstein. I have never met with it, but have a very large old male specimen in which the shagreening of the skin is more than usually developed, given me by Mr. A. G. Hamilton, whose son found it in a creek-bed at Hartley, Blue Mts.

BUFONIDÆ.

9-10. Pseudophryne australis, Gr., sp., and P. bibronii, Gthr.

Mr. Boulenger suggests that the latter may prove to be a mere variety of the former; but this view will not I think commend itself to anyone who is familiar with the frogs in their natural conditions. Not only is there the well-marked and very constant difference in colour and pattern, but the frogs differ more or less in temperament, in habits, and in regard to the breeding season.

P. australis is a lively perky little frog, very partial to damp shelves and cracks in the Hawkesbury sandstones; and breeds earlier—three times I have found ova, in November, January, and this year as late as May 11th, but early in September I once saw a pair *in coitu*, though I do not know that spawn was deposited. *P. bibronii* on the other hand is much less active, usually makes little or no effort to escape when uncovered in its hiding place, "shams dead" when placed on its back, and falls to the bottom like a stone when thrown into water; I have never found it except on the ground under stones, logs &c.; I have found the ova every year for seven consecutive years, once in April only, thrice in May only, once in June only, and twice in both April and June.

The two species agree in regard to their oviposition and general development. The ova are laid after rain in depressions or cavities, preferably under stones, but when these are wanting under pieces of old tin, under débris brought down by the water, or in a tussock of grass or reeds, near the margins of ponds or creeks. That they have been deposited where one finds them is obvious from the circumstances under which they occur. To satisfy myself that the ova could be fertilised without being placed in water I collected at different times males and females of both species. In two instances on reaching home at least one couple were *in copula*, the embrace being inguinal; these subsequently spawned on a damp rag placed at the bottom of a dish, the ova as shown by their subsequent development being duly fertilised. Several hundred ova may sometimes be found in the same little cavity, but these have been deposited by several females. In the two instances above-mentioned each frog laid about ninety ova; and these were disposed in short rows or in masses of a dozen or more, at some distance apart, showing that the frogs had moved some distance every now and then and probably slightly after the deposition of each ovum. The ova would seem to be fertilised singly. If the surroundings are moist the ova, (including the gelatinous envelope,) are about as big as peas,

spherical, 3-5 mm. in diameter; if in contact they adhere to one another slightly but are readily separable with a feather, and do not fuse into a mass. The ova themselves are twice the size of ordinary frog ova.

The pigmented pole is black, the other cloudy white. The segmentation is complete, but on account of the considerable amount of food-yolk very irregular; the pigmented pole segments much more rapidly than the other; and in some segmenting ova which I observed, after the stage in which there were two vertical and one transverse furrow the next two vertical furrows instead of continuing round the lower pole frequently turned to one side and joined one of the original vertical furrows. As I hope to give a more complete account of the development hereafter I need only briefly refer to subsequent events. By about the fifth or sixth days the embryo is well-folded off from the large yolk-sac; a day or two later the embryo may be noticed at times to exhibit wriggling movements, and about this time the two developing claspers or suckers begin to show prominently. But neither up till now or at any subsequent stage have I been able to see any trace of external gills, and I believe these are not developed. Gills and tentacular reticulations such as Heron-Royer describes* in *Alytes obstetricans*, if present could hardly be overlooked; moreover external gills are noticeable enough in the newly hatched tadpoles of the species which oviposit in water; hence I am unable to say how respiration is provided for in the early stages unless the tail functions as a respiratory organ. [After a time a single spiraculum is present on the left side as usual. In keeping the tadpoles in aquaria individuals may sometimes be found floating at the surface of the water, the ventral surface uppermost, and every now and then ejecting a number of bubbles of gas sometimes from the mouth and sometimes from the anal aperture, while numbers of small bubbles may sometimes be seen in the spirally coiled intestine; at other times the tadpoles appear to be swallowing air, and often accidentally re-swallow the bubbles previously ejected.

* Bull. Soc. Zool. de France, 1883, p. 423.

These phenomena, may, however, be pathological, as the individuals sometimes seem sickly, and may have nothing to do with respiration; but I have never seen anything like it in tadpoles of other species.] Development proceeds steadily, the tadpoles becoming more and more recognisable, until after between a fortnight or three weeks from the time of laying they are ready for hatching. By this time in order to accommodate itself to the size of the chamber in which it lies the tadpole bends its tail round to one side, the tip reaching to the snout or beyond; from time to time the position is changed by bending the tail the other way. If now a number of the ova are placed in water some of the tadpoles will emerge very shortly, while others may not do so for a day or two. They emerge through a usually more or less circular hole; but I have never been able to observe the actual exit though I have watched for it, and have several times seen them with the tail free, but these may be cases of misadventure. Possibly the tadpole with its horny beaks first weakens a spot in the envelope softened by moisture, and then deliberately increases the strain, as Royer describes in *Alytes* (l.c. p. 428). If the ova do not get into the water the hatching is simply postponed till they do, a proceeding which at any rate for a period of at least three months, provided of course that they are not absolutely deprived of moisture, seems to cause little inconvenience. They can stand a good deal of dessication without damage; and anyone who sees specimens which have undergone some drying up for the first time would hardly believe that the contained tadpoles are still alive; nevertheless on the addition of water the gelatinous matter again swells up as before; under these circumstances if the ova are left in the water the tadpoles seem to hatch more quickly than otherwise.

Balfour in his *Comparative Embryology* (Vol. II. p. 115) mentions the large yolk-sack of *Pseudophryne australis*. This is evidently correlated with the ability to endure a postponement of the hatching. Oviposition takes place after heavy rain, and the next fall of rain has to be depended upon for the release of the

tadpoles; but the intervening period may be one of weeks or months. On July 29th, 1885, I exhibited at a meeting of this Society [*vide* Proceedings x, p. 342] ova of *P. bibronii* (not *P. australis* as there mentioned) obtained in the previous April, that is to say a period of between three and four months, yet the tadpoles seemed to be none the worse; after reaching the condition of readiness for hatching they increased but little in size, and there was a marked difference in this respect between tadpoles of the same batch allowed to hatch at different times. I have not yet ascertained the limit of endurance, but it was certainly not reached in the above case. The only difficulty to be contended with is to keep the ova sufficiently moist and yet keep them free from attacks of moulds. I kept them in the hope of seeing them complete their metamorphoses without gaining access to water; this however they seem unable to do. The tadpoles are very hardy, strikingly so as compared with those of other species. A number of them may be hatched out in a wine-glassful of water and left for a fortnight or longer without the water being changed or any food supplied, and yet they seem none the worse for such treatment which would be fatal to ordinary tadpoles.

The above-mentioned facts explain the sudden appearance of large numbers of the tadpoles in pools and ponds after heavy rains, which when previously visited were dry or contained no tadpoles, and when the intervening interval has been too short to allow development to have reached the stage met with. I have met with instances of this kind frequently, but the tadpoles have always being referable to one or other of the species of Pseudophryne; and I have seen nothing to warrant the supposition that the tadpoles of other species by burying themselves in the mud can survive for any length of time if, as frequently happens, the ponds dry before the completion of the metamorphoses; if they could one would expect to find instances of their sudden re-appearance after rain has again filled the ponds. Balfour (l.c. p. 116) also says: "The tadpoles of Toads are the smallest, *Pseudophryne australis* excelling in this respect." When hatched the tadpoles of both species are about 10 mm. long of which the

tail is 7 mm., and the body about 2 mm. broad. They grow pretty rapidly when they are well fed, until they are about 25 mm. long, the body being about 8-10 mm. long and 5-6 mm. broad. They are of a dark colour, blackish, greyish or dark brown, becoming lighter, olive brown, as they grow older, with innumerable minute bronzy specks especially on the ventral surface. The ova and tadpoles of the two species are indistinguishable as far as I can see at present, the larval frogs not acquiring the colours of the adults, but they probably do so very soon after quitting the water, as I have a young specimen of *P. australis* found early in April, about 10 mm. long, which has the characteristic markings. In several instances tadpoles hatched from ova found in April, and kept in an aquarium, completed their metamorphoses in the September following; but this is probably at least twice as long as is necessary under natural conditions.

HYLIDÆ.

11. Hyla cærulea, White, sp.

One of our commonest species, but I have never been able to catch the frogs breeding. Two males taken towards the end of January both have breeding rugosities. In the first week in March a number of tadpoles captured a fortnight previously completed their metamorphosis; three of the young frogs, now in spirit, measuring about 17 mm. from snout to vent, and two of them having a few white spots on the back and sides. The pond from which these specimens came was in the middle of a grass paddock, and was periodically visited by me; and I have no doubt that the ova were deposited in water in the ordinary way. This species begins to be seen and heard later even than *H. aurea;* and appears to breed during the summer months. Mr. A. G. Hamilton informs me that at Guntawang in the Mudgee district early in February, on one occasion in a tuft of grass at some little distance from water he found a pair *in coitu*, the embrace being axillary.

12. Hyla peronii, D. & B., sp.

All my specimens have been captured in the post-holes in fences, in which, in one locality when not too dry I could generally (in the

daytime) find at least one specimen asleep—when they are nearly white—from about October to April. Early in December hearing a number croaking in the neighbourhood of a pond, and guided by the croaking I caught a male in a post-hole, with a brown rugosity on the first finger of each hand; judging from the croaking the others appeared to be on the ground but hidden under the banks, and I suspect they were preparing to spawn, and that they do so in the ordinary way. A large tadpole with well-developed hind legs is 61 mm. long of which the body is 21 mm.

13. Hyla phyllochroa, Gthr.

This species is common in shady gullies. During the summer months a few of these frogs may generally be found in Mr. Macleay's bush-house, in the day-time asleep on the plants. On four different occasions, in December (twice), January, and February I have seen a pair *in coitu* in the water-cask used by the gardener in the bush-house. They can only spawn comfortably when the casks are quite full; the female then sits on the bevelled edge of the cask looking outwards with the hind-quarters in the water. The pigmented pole of the ova and the young tadpoles themselves are rather pale yellow, and this will help to distinguish them from the darker yellow prevailing in *H. ewingii* var. *calliscelis*. In the same three months of the following year spawn was again found on three occasions, but I did not happen to find the frogs. Under more natural conditions the spawn is attached to blades of grass, twigs, &c. (as Mr. Hamilton has informed me); and they also spawn earlier than the above dates, as in October last in a gully near Kiama in the day-time my attention was attracted by croaking, and on going to see I found a number of these frogs having a sort of field day at the opening of the breeding season just as I have noticed several times in the case of *H. aurea*; a number of the frogs were in the water, and very active, the males croaking vigorously and every now and then making a grasp at the females. No spawn was visible, but I was unable to visit the spot again.

14. HYLA DENTATA, Kef.

A rare frog. I have only taken two specimens and these not full grown. I know nothing of the habits of this species.

15. HYLA CITROPUS, P. & L., sp.

Not common. Mr. Krefft gives Ryde and Hunter's Hill as localities. I have not found it nearer than Waterfall; also in the gullies at Mt. Wilson. In September last at Waterfall a pair of this species were found *in coitu* on the damp rocky bed of the creek close to water. They were caught without difficulty and spawned in a dish containing water 24 hours later, the male never relaxing his hold as far as observed. The male has a blackish rugosity on the first finger of each hand.

16. HYLA EWINGII var. CALLISCELIS, Peters.

One of our commonest frogs, whose shrill notes may be heard all the year round when the weather is not too dry. This species probably breeds pretty nearly throughout the year. On June 16th, 1885, under a large stone about a yard from the edge of a pond I took a pair *in coitu*, which allowed themselves to be caught without trouble; the female spawned on the evening of the 19th, the male so far as observed not having relaxed his position on the female's back. The male is much smaller than the female, and has a brownish rugosity on the first finger of each hand. The ova have the pigmented pole orange. Similar ova in bunches attached to twigs, blades of glass, &c., I have found in from May to September, but some of it may have been laid by *H. kreffiii.*

What I take to be this species also sometimes (in different years I have noted it in November, December, January and February) spawns in the water-casks under similar conditions to *H. phyllochroa.* The gardener has frequently seen them; I have seen the spawn, but have always been too late to see the frogs themselves; from his description, and from the characters of the spawn there can be I think little doubt about the species. In the middle of November 1885 I found hundreds of advanced tadpoles

in the liquid mud of a pond which was in the last stage of drying up; a week later several of them completed their metamorphoses crawling out of the water up the side of the jar; two of these now in spirit are about 12 mm. from snout to vent.

18. Hyla krefftii, Gthr.

Not very common about Sydney; have taken specimens on *Zamia* at Randwick early in March; also numerous specimens under logs at Burrawang in July, some of them females distended with ova. Hence this species probably breeds in spring or early summer, but I have not yet been able to obtain any details about the oviposition. On a *Zamia* at Randwick when collecting specimens of this frog with Mr. Masters, pellets of excreta were noticed consisting largely of fragments of the elytra &c. of beetles, whereupon Mr. Masters pointed out to me that two Curculios (*Tranes internatus* and *Epizeuxis lyterioides*) frequent the Zamias, so that it seems likely that the Hylas haunt the Zamias to feed on these beetles.

19. Hyla aurea, Less., sp.

This species breeds from about the middle of spring through the summer. In three successive years in the same pond about the end of September numbers of this species were noticed in a considerable state of excitement, the males darting at and seizing the females; but little or no spawn was deposited. Early on the morning of October 20th, 1886, in the pits in a disused tan-yard I found a number of couples *in coitu*, as well as a good deal of spawn; the female of a couple which I caught and took home commenced to spawn during the day in a dish of water, and completed the operation some time during the succeeding night, the male never relaxing his hold. In the first week of December of this same year I also found breeding couples. I have noted finding young frogs, which had just about completed their metamorphosis, common about the margin of swamps in December, March and April; and tadpóles at the beginning of April in a pond in which there were also tadpoles of two other species of *Hyla*, one

of them *H. cœrulea*, examples of all of which were to be met with in which at least the hind legs were well developed. The larval frogs of this species acquire golden stripes before leaving the water. I have noted as unusually early seeing two specimens of *H. aurea* on the margins of a pond on July 31st, and of hearing and seeing a number on August 20th of the same year.

20. Hyla lesueurii, D. & B.

I have not taken this species nearer than Bulli where it was not uncommon under stones in June. I have also found a few specimens in the gullies at Springwood in January; from the conditions under which these were found this seems to be a terrestrial species diurnal in its habits; the chestnut tinge of the back harmonises with the dead leaves and strips of bark lying about on the ground; so that seeing a good specimen, but taking my eye off for an instant, it was some time before I could recognise it again though it had not moved. This is a common species in the Mudgee district whence I have numerous specimens of various sizes sent me by Mr. Hamilton, and a fine example sent me alive by Mr. J. D. Cox. I have no information at present about the oviposition.

21. Hyla latopalmata, Gthr., sp.

Two specimens are in the British Museum from Richmond. I have found only a single specimen which jumped up in front of me while walking across a grass paddock between a swamp and the banks of South Creek at St. Mary's.

22. Hyla freycineti, D. & B., sp.

Common about the swamps near the coast from Botany to Narrabeen. Early in August among the reeds in a large pond, vociferous croaking was going on, attracting one's attention even at a distance; a good deal of frothy spawn was visible, but the frogs were too shy and the pond was too full to get near them. The croaking of *Limnodynastes tasmaniensis* was recognisable, but that of the majority of the frogs was new to me, and I suspect

them to have been *H. freycineti.* In the middle of last April I found a number of tadpoles just about completing their metamorphoses, about 35 mm. long, the body 15 × 7 mm. Towards the end of March in the previous year numbers of young frogs which had only recently taken to land were common about the edges of swamps at Botany. Three males taken as late as the beginning of April have a brownish rugosity on the first finger of each hand. There can I think be little doubt that this species breeds in spring and summer, and oviposits in water in the ordinary way. This species may possibly hibernate buried in the mud, as unless the frogs travel some distance in some localities there is a dearth of suitable shelter.

23. Hyla dimolops, Cope.

This species, mentioned in the British Museum Catalogue as from Sydney, I have never met with.

24. Hylella bicolor, Gr., sp.

I have never met with this frog. Krefft gives as localities "30 miles from Sydney, and Blue Mts." In Professor Parker's third memoir "On the Development of the Skull of the Batrachia" (*Phil. Trans.* 1881, p. 158) the locality Dogtrap Road, Parramatta is mentioned for it.

In regard to the foregoing list the following points may be noticed:—*Limnodynastes ornatus* occurs in Keferstein's list* under the two names *Platyplectrum marmoratum* and *P. ornatum*, for each of which the locality Sydney is given. In Steindachner's list † Sydney is given as a locality for *Cryptotis brevis*. I have specimens of the former from Mudgee collected by Mr. A. G. Hamilton, and I have found examples of the latter in gullies in the Blue Mts.; but I have not found them in the County of Cumberland nor have I met with any who has. These two, and a similar remark possibly applies to *Helioporus albo-*

* "Ueber die Batrachier Australiens," Arch. f. Naturgesch. 1868, Bd. i, p. 253.

† "Reise der Novara," Amphibien.

punctatus and *Crinia georgiana*, are either rarer than they used to be since resident collectors do not find them, or, what is perhaps more probable, the earlier collectors of frogs used the term Sydney in a similar somewhat elastic sense to that in which the early botanical collectors are known to have used the term Port Jackson. Dr. Keferstein was indebted to Mr. Krefft for some of his material; but it is noteworthy that though Krefft's latest list was published about two years later than Keferstein's paper, yet the former does not give Sydney as a locality for *L. ornatus*; nor indeed for any of the other species in question, nor for *L. salminii*. If we except *Crinia georgiana*, this is not a matter of much importance, as the others undoubtedly occur in New South Wales. But, as far as I can learn, the British Museum specimens of *Crinia georgiana*, which were acquired by purchase, are the only specimens recorded from New South Wales, and in this colony from Sydney only; in which case, and if the collector did not mix his specimens, it is remarkable that it should not have been again found here.

Mr. Krefft frequently refers to *Hyla verreauxii*, a name which does not occur at all in Mr. Boulenger's Catalogue, but which he tells me in a letter was unintentionally omitted, and that it is probably a variety of *H. ewingii*. From Mr. Krefft's remarks about it I suspect that he refers to the frog now known as *H. ewingii* var. *calliscelis*.

NOTES AND EXHIBITS.

Mr. C. T. Musson, F.L.S., contributed the following notes :—

(1) "In June, 1887, I shot on the border of a small artificial dam, on Boolcarrol Station, 30 miles north of Narrabri, N.S.W., two specimens of the Top-knot pigeon *(Lopholaimus antarctica,* Sharw.), one of which on examination was found to have a curious ball of earth on each leg, caked quite hard and completely surrounding the leg just clear of the ground when the bird was walking. One of the legs was cut off, with its accompanying incubus, and is sent herewith for exhibition*; unfortunately the connection between the clot and leg has become severed. The larger ball only is shown, but it will be noticed that it is of considerable size, and no doubt accumulated as the bird wandered about on the muddy margin of some water-hole. One need hardly dilate on the importance of birds as seed-distributors,—a question which has been thoroughly discussed by Darwin, Wallace, and others; but when we find an example of one of the many methods of distribution capable of demonstration, it is well to note the fact. In this case the amount of earthy matter is not great (weighing 9 grains), but there is ample for the inclusion of many such seeds as are likely to be lying about in places where pigeons might be in the habit of alighting for water."

(2) "Whilst collecting on Mount Archer, near Rockhampton, Queensland, during September, 1887, I found under some loose stones in one of the numerous gullies, a Coleopterous insect, carrying on one of its elytra a specimen of a land-snail *(Vitrina).* It does not require a very great stretch of imagination to consider that, could the insect have taken flight with this strange companion as passenger, it might have been the means by which distribution would have been aided, and thus a new colony be started where possibly the species had been before unknown."

* The specimen was duly exhibited.

(3) "On the effects of eating pigeons which have fed on the seeds of *Euphorbia Drummondii*, Boissier.—During a residence in the north-western district of New South Wales (Namoi), 1887-1888, I noticed a peculiar effect produced on human beings, under the following circumstances. Whenever our household partook of pigeon pie it invariably followed that after some 12 or 15 hours we all suffered under a severe attack of diarrhœa, accompanied by acute griping pains in the bowels, lasting some three or four hours and then passing away. This effect had so constantly and invariably followed the presence of pigeon pies on our table that I naturally connected the one with the other, and cast about for an explanation. We had noticed in cleaning the birds that their crops were filled with small rugose seeds, which only recently I have found to be those of *Euphorbia Drummondii*, Boiss., which grows in profusion with us, covering a considerable area of ground in that portion of the garden devoted to grape vines, the pigeons feeding regularly on the Euphorbia fruits. This plant is stated to be injurious to stock, and we know that many members of the spurge family possess purgative and emetic properties, whilst others are powerful irritants. The question then naturally arises whether some of these peculiar properties have taken effect upon us in the indirect manner here set forth thus to bring about the results indicated? All the ingredients of our last two pies (the last one partaken of out of curiosity as a further test) were most carefully examined, and I have come to the conclusion that the cause of the mischief is indirectly attributable to *Euphorbia Drummondii*."

Dr. R. B. Read communicated a note on the circumstances under which Australian Coal first came into use by foreign steamships.

Mr. Fletcher exhibited for Dr. Woolls the plants sent by the Rev. R. Collie. Also the ova and tadpoles of both *Pseudophryne australis* and *P. bibronii* referred to in his paper.

Mr. Trebeck exhibited a living specimen of a snake (*Vermicella annulata*) from Annandale.

Dr. Katz exhibited the drawings accompanying Bordoni-Uffreduzzi's paper on the cultivation of leprosy-bacilli (Zeitschrift für Hygiene, Band III., Heft 1, 1887); also a pamphlet with illustrations of the gas-making apparatus mentioned in his communication on "air-gas." He also handed round the first number of the third volume (1889) of the "Annales de l'Institut Pasteur," in which the Pasteur Institute is described and illustrated; and the first two numbers of the "Microphotographic Atlas of Bacteria," which is being brought out by Dr. C. Fraenkel and Dr. R. Pfeiffer. Special attention was drawn to an admirable photo of *Amphipleura pellucida* (× 1000), in which the striæ were plainly seen to consist of a system of minute dots or nodules.

Mr. Rohu sent for exhibition an Egyptian mummy hand.

WEDNESDAY, 26TH JUNE, 1889.

Mr. Robert Etheridge in the Chair.

Messrs. T. B. Trebeck, M.A., R. Helms, W. Anderson, and S. A. Wise were introduced as visitors.

Mr. C. M. Woodford, Sydney, was elected a Member of the Society

The Chairman announced that the next excursion had been arranged for July 27th. Members to leave Redfern Station, for Clifton, Illawarra line, by the 9·10 a.m. train.

DONATIONS.

"The Transactions of the Royal Irish Academy. Vols. XI.-XV.; XVIII.; XX.-XXVIII.; XXIX. (Parts 1-5), (1810-89); "Journal of Botany," n.s. Vols. VIII., No. 204 (December, 1879); IX.-XI. (1880-82); "Challenger Reports—Zoology." Vol. XXX.; "Encyclopædia Britannica." 9th Edition, Index; "Nouvelles Archives du Muséum d'Histoire Naturelle, Paris." 2nde. Série. Tome X., Fasc. 2 (1888); "Zeitschrift für wissenschaftliche Zoologie." XLVII. Band, 4 Heft (1888); "Notes from the Leyden Museum." Vol. XI., No. 1 (1889); "The Origin of Floral Structures through Insect and other Agencies." By the Rev. George Henslow, M.A., F.L.S., &c.;

"The Morphology of the Skull." By W. K. Parker, F.R.S., and G. T. Bettany, M.A., B.Sc.; "Berliner Entomologische Zeitschrift—herausgegeben von dem Entomologischen Verein in Berlin." Band XXXII., Heft 2 (1888); "Stettiner Entomologische Zeitung." 50 Jahrg., Nos. 1-3 (1889). *From Sir William Macleay, F.L.S.*

"Dept. of Mines, Sydney—Memoirs of the Geological Survey of New South Wales—Palæontology, No. 2. Contributions to the Tertiary Flora of Australia." By Baron von Ettingshausen. (1888); "Melbourne Centennial International Exhibition, 1888—Descriptive Catalogue of Exhibits of Metals, Minerals, Fossils, and Timbers in the N.S.W. Mineral Court." *From the Minister for Mines.*

"The Australian Museum, Sydney—Memoirs, No. 2.—Lord Howe Island, its Zoology, Geology, and Physical Characters." *From the Trustees.*

"Mémoires de la Société Zoologique de France pour l'Année 1888." Tome I., No. 3; "Bulletin pour l'Année 1889." Tome XIV., No. 2 (February). *From the Society.*

"Transactions and Proceedings of the New Zealand Institute, 1888." Vol. XXI. *From the Institute.*

"Report of the Central Park Menagerie, New York, for 1888." *F om the Director.*

"Proceedings of the Royal Society of London." Vol. XLV., No. 276 (1889). *From the Society.*

"Feuille des Jeunes Naturalistes." No. 223 (May, 1889). *From the Editor.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CVIII., Nos. 9-12 (1889). *From the Academy.*

"Bulletin of the American Geographical Society." Vol. XXI., No. 1 (1889). *From the Society.*

"Proceedings of the United States National Museum." Vol. XI. (1888), Sheets 16-19. *From the Museum.*

"The Journal of Comparative Medicine and Surgery." Vol. X., No. 2 (1889). *From the Editor.*

"Sydney Free Public Library—Report from Trustees for 1888-89." *From the Trustees.*

"Report of the Trustees of the Public Library, Museums, and National Gallery of Victoria for 1887," &c. *From the Librarian.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 306 and 307 (1889). *From the Editor.*

"The Transactions of the Entomological Society of London for the year 1889." Part 1. *From the Society.*

"Proceedings of the Asiatic Society of Bengal, 1888." Nos. IX. and X. (Nov. and Dec.); "Journal." n.s. Vols. LVI., Part ii., No. 5; LVII., Part ii., No. 4 (1887-88). *From the Society.*

"Archives Néerlandaises des Sciences exactes et naturelles." Tome XXIII., Liv. 2 (1889). *De la part de la Société Hollandaise des Sciences à Harlem.*

"Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino." Vol. IV., Nos. 53-61 (1889), and one plate. *From the Museum.*

"Calendar of the University of Sydney for the year 1889." *From the University.*

"Transactions and Proceedings and Report of the Royal Society of South Australia." Vol. XI. (1887-88). *From the Society.*

Two pamphlets—"Poissons Lune *(Orthagoriscus mola)* capturés pendant deux Campagnes de l' *Hirondelle*;" "Le dynamomètre à ressorts emboîtés de l' *Hirondelle*." Par le Prince Albert de Monaco. *From the Author.*

"The Proceedings of the Royal Society of Queensland, 1889." Vol. VI., Parts 2 and 3, *From the Society.*

"Abstract of Proceedings of the Zoological Society of London," 16th April, and 7th May, 1889." *From the Society.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 42 (June, 1889). *From the Editor.*

"Geological Survey of Queensland—Preliminary Report on the Limestone District, part of the Palmer Goldfield." By R. L. Jack, Government Geologist. *From the Director.*

A LIST OF THE BIRDS OF THE MUDGEE DISTRICT, WITH NOTES ON THEIR HABITS, ETC.

By J. D. Cox and A. G. Hamilton.

Having observed and collected the birds of the Mudgee District for many years, we think it may be of interest to give a list of them, adding notes, though by no means exhaustive, on their habits, etc.

A preliminary account of the geography of the district is necessary to the full understanding of the list, as otherwise the fact of such birds as *Menura superba* and *Sericornis frontalis* appearing in it would be inexplicable.

The Mudgee District lies in the north of the South Table-land, extending from the Dividing Range to the slope towards the plains. It is separated from that part of the coast district occupied by the upper valley of the Hunter River by the ridge of the Blue Mountains, here narrow and low, the formation being Hawkesbury sandstone. This situation renders it easy to understand why we have an avi-fauna partaking of the characters of both the plains and the coast district, as well as that proper to the table-land. Towards the north-east, at no greater distance than 30 miles from our west boundary, the plains begin at Dubbo, and an arm of the flat country runs up the valley of the Talbragar River nearly to Cobbora, 50 miles from the town of Mudgee (which lies south of the centre of the district). Again, on the north-east the district is divided from the Liverpool Plains by that spur of the Liverpool Range called the Warrumbungle Mountains. Hence we see why such birds as *Eupodotis*, *Dromaius* (once common in the district, but now, as far as breeding and

constant residence go, extinct), *Geronticus*, *Threskiornis*, and *Grus australasianus* should at times be found in numbers. Again, the western slopes of the Dividing Range at Cooyal, 18 miles east from Mudgee, are clothed with vegetation resembling that of the coast brushes, and here *Menura*, *Sericornis*, *Ptilonorhynchus* and other coast forms are plentiful.

The district is bounded on the east by that part of the Blue Mountains extending from Cassilis on the north to where the Hunter Range begins at Mount Coricudgy; thence the south boundary runs westward along the Dividing Range to the spur forming the watershed beween the Meroo River and the Cudgegong, and along that spur to the head of the Meroo. The east boundary runs along that stream to its embouchure into the Cudgegong, and then northward to Cobbora. From Cobbora the Talbragar River eastward to the point of commencement forms the northern boundary. The average length of the district is about 60 miles, its breadth 35 miles, and its area may be estimated at about 2000 square miles.

From this it will be seen that it takes in the valley of the Cudgegong in its entirety, and also includes the affluents of the Talbragar on the left bank, and those of the right bank of the Meroo. It includes in its borders the peaks of Durambang, Coricudgy (3000 feet), and just leaves out Tayan Peak (4000 feet); and it also takes in the curious basaltic hill, Bocoble, which is 3500 feet high. We have come to the conclusion that the height of Mudgee itself, 1635 feet above the sea, is a fair average for the district. Mount Frome, a limestone peak capped with slaty stone, rises to a height, as measured by one of us, of 820 feet above the river bed, about 2455 feet above the sea, and Dwéaldjeree is 1640 feet above the river—about 3200 feet absolute height. This last peak is of igneous origin, and in the creek rising on its west flank the vegetation is of a different character, *Eucalyptus globulus*, *Pittosporum undulatum*, and other plants unknown in the rest of the district occurring there. Here a few insects and birds live which are not general all over the district.

The whole district is well watered by the Cudgegong and its tributaries, and although rugged and barren in places, is very rich in minerals. The valley of the Cudgegong is fertile, and while the flats are eminently suitable for agriculture, the uplands are unequalled for sheep raising, and for pastoral purposes generally. The whole of the country, though now much cleared, was originally timbered, in places very heavily, principally with Eucalypts and apple-trees (*Angophora intermedia*).

In regard to its geological features, the principal formation is Silurian, and the Coal-Measures extend from the Dividing Range to Guntawang and Beaudesert, where shales occur, and by Tallewang and Cobbora (where coal has been found) to Dubbo. As already mentioned, at Cooyal the Hawkesbury sandstone composes the Dividing Range. Near Home Rule granite occurs and outcrops of igneous rocks are seen in various places. Limestone also is found in a few spots.

1. Circus assimilis, *Jard. & Selb.*

Most commonly met with in the spring months when it builds among wheat and long grass on the river flats. Nest, a few sticks placed triangularly. The egg is white, rather rough, and has a greenish-blue lining membrane.

2. Astur Novæ-Hollandiæ, *Gmel.*

A rare bird here.

3. Astur approximans, *Vig. & Hors.*

Very daring birds, attacking pigeons and chickens close to the house, and even killing such birds as *Dacelo gigas*.

4. Accipiter cirrocephalus, *Vieill.*

These birds breed in the district, sometimes building a nest for themselves or taking possession of an old magpie's nest. They kill small birds, but seldom touch *Myzantha garrula*, notwithstanding their numbers. We have, however, seen them attack these birds when mobbed by them.

5. Aquila audax, *Lath.*

Breeds in the district. All the nests we have seen have been in easily accessible trees, and were of enormous size, being evidently, as Gould states, added to every year. We have known them to attack a foal, and full grown kangaroos, two taking turns in chasing them. The wing stretch in one we shot was 7 feet, and weight 10 lbs; another was 6 feet 11 inches. One of us saw a tortoise in the grip of a wedge-tailed eagle, which when approached dropped the animal from a height.

6. Haliastur sphenurus, *Vieill.*

Not a common bird.

7. Milvus affinis, *Gld.*

We have known this bird to swoop down and carry away the meat off a dish as it was being taken from the kitchen to the house.

8. Lophoictinia isura, *Gld.*

We have shot only one of these birds, at Guntawang.

9. Elanus axillaris, *Lath.*

In 1880, and again in 1886, large flocks of these birds came to Guntawang in the autumn. They frequented the flats and low foot hills covered with scrubby vegetation, living on lizards, and "small deer" generally, but we have known them to kill quail: they roosted at night in dead trees along the river bank.

10. Falco melanogenys, *Gld.*

Usually comes to the district in March and April.

11. Falco hypoleucus, *Gld.*

A specimen shot at Springfield by Mr. Garling, one near Mudgee by the late Mr. H. Thurston, and one by ourselves at Cullenbone, areall we have seen of this beautiful falcon.

12. Falco lunulatus, *Lath.*

Rather rare.

13. Hieracidea orientalis, *Schl.*

Rarely visit the district, but when they do are very numerous.

14. Tinnunculus cenchroides, *Vig. & Hors.*

Usually nests in hollow spouts and sometimes in deserted nests.

15. Strix flammea, *L.*, *sub-sp.* delicatula.

A specimen shot by the late Mr. H. Thurston is in the reading-room of the Mechanics' Institute, Mudgee. They are said to be plentiful in the orchard at Puttabucca when the fruit is ripe. Probably the windfalls attract mice, and the owls follow. We have also a specimen from Coolah.

16. Ninox boobook, *Lath.*

A very common bird, breeding in hollow trees. Its booming cry is continually heard in the spring months.

17. Aegotheles Novæ-Hollandiæ, *Lath.*

We have shot three specimens all differing much in colour from Gould's figure, being dull ashy-greys without the warm tints shewn in figure alluded to. Eggs December 7th.

18. Podargus strigoides, *Lath.*

Breeds in spring and early summer. We have taken eggs October 4th to 15th November, and seen them sitting on the unfledged but downy young on November 15th.

It is probable that we have more night-birds than the above four species. We have certainly seen *Eurostopodus guttatus*, but having failed to shoot it, we have not included it in this list.

19. Chætura caudacuta, *Lath.*

A regular visitant. We have observed flocks in January, February, March, April, July, August, and December.

20. Cypselus pacificus, *Lath.*

We have seen this bird only in among the flocks of *Chætura.*

21. Hirundo neoxena, *Gld.* (=H. frontalis, *Q. et Gaim.*).

The majority of individuals are regular summer visitants, but some remain all the year round. They begin their nests late in July; the earliest eggs we have seen were found on 7th August, and then are to be found on to middle of December. Each pair rears several broods. Gould says they build in smoky chimneys, but we have never found a nest in such a situation, though in every other possible place about houses we have observed their nests. We have never seen a nest in a tree or anywhere but in a building. They take their bath on the wing.

22. Petrochelidon nigricans, *Vieill.* (= Hylochelidon).

Some few remain all the year, but the bulk leave in May and reappear in August. Eggs in October, if not earlier. One of us has on several occasions found morsels of the shell of the river mussel (*Cyclas*) in the mouth of shot specimens, for what purpose we are unable to say.

23. Lagenoplastes ariel, *Gld.*

We have seen this bird as early (or late) as 1st June. They are plentiful in the first week in August. When they arrive, they roost for some nights in packs in the reeds on the river banks; and when preparing to migrate in April, they gather in dense flocks about sunset and fly up and down the river for an hour, sometimes rising to a great height in the air, and then coming down nearly perpendicularly, ending by roosting in the reeds as when arriving. In the month of February, 1887, they behaved in this way for a few days, and then resumed their ordinary habits till April 7th, when they packed and departed. We have taken the eggs from 1st September to December. Gould says they club together in fives and sixes to build a nest, but we have never seen more than two building, although one of us has seen three or four feeding the young, probably themselves young of an earlier brood assisting their parents. When their nests are built on the river banks, they hear a footstep or feel the vibration at a great distance, and, flying out with distressed cries, encircle the intruder.

Each pair very jealously guards its nest, and fights are common on this account. They build in angles of beams supporting loft-floors, along eaves of houses, under culverts and bridges, and on the steep clay-banks of the river.

24. Merops ornatus, *Lath.*

Arrive here on September 25th, and later, in ones and twos. They come in numbers in the first week in October, and begin nests at once. A sure sign of the completion of the nest is the bluntness of the beaks. Eggs may be taken from the beginning of November till the latter end of December. The main body leaves in February, but we have seen a few as late as March 11th. They are very destructive to bees, like their European representative, and when a pair nest near a hive they live almost entirely on them. Plunges into water for bath.

25. Eurystomus pacificus, *Lath.*

These birds arrive about October 1st, and leave in February. They nest in hollow trees, and we have seen young birds being fed late in December.

26. Dacelo gigas, *Bodd.*

We have repeatedly seen this bird plunge in dams and the river, and secure crayfish or prawns.

27. Halcyon sanctus, *Vig. & Horsf.*

They begin to arrive early in September, the nest is nearly finished on October 3rd, and we have taken eggs in October and up to November 20th. We have seen them as late as March 21st. This bird, too, dashes into the water after its prey. When skinning, one of us has found worms between the skin and the flesh.

28. Halcyon pyrrhopygius, *Gld.*

We have noticed this bird first on September 8th, and taken eggs on November 18th. Last seen on March 21st. They have

a *penchant* for sitting on the telegraph wires; otherwise they rarely perch on anything but dead twigs in trees.

29. Halcyon Macleayi, *Jard. & Selb.*

A specimen shot by Mr. H. Thurston at Holyoak Bridge, Mudgee, is in the Mechanics' Institute in that town; but as Gould states it extends from Moreton Bay to Coburg Peninsula, it must be considered as an accidental visitor, or stray.

30. Alcyone azurea, *Lath.*

The eggs are laid on a pile of shrimp carapaces and small fish bones, which smells just as vilely as the nest of its British representative.

31. Artamus sordidus, *Lath.*

Some remain all the year round, but the majority come in flocks, and then break up into pairs. These arrive about September 3rd. On one occasion we observed about 100 going into a large hollow in a tree to roost, those for which there was no room roosting on the edges outside. Eggs from October 26th to January 26th.

32. Artamus personatus, *Gld.*

Vast flocks mingled about equally with the following species arrive in September, and remain packed for a considerable time. Eggs from October 24th to November 18th.

33. Artamus superciliosus, *Gld.*

For many years this species and the last came here in great numbers in September, dispersed and built early in October, and then after packing in latter part of December for a week or two, departed in January, none being left by the 14th of that month. In 1886, however, not a single bird came. In 1887 a flock of *A. personatus*, and none of species under notice, arrived on September 11th. No birds, perhaps, are so careless in their nidification as these two species. We have taken two eggs from a

nest composed of green clover leaves, quite fresh and moist, placed in a knot-hole of a fallen tree. Eggs October 6th to November 18th. All three species are locally known as "Blue-larks" and "Martins."

34. PARDALOTUS PUNCTATUS, *Temm.*

Rare in most parts of the district, but common at Cooyal on the Dividing Range, eighteen miles east of Mudgee. Eggs October 12th. Known as "Diamond-bird."

35. PARDALOTUS ORNATUS, *Vig. & Horsf.* (=P. STRIATUS, *Temm.*)

This bird here, in addition to its habit of nesting in hollow branches and Fairy-martins' nests, also burrows into banks on river sides and creeks, building a stringy bark nest about 18 inches from opening It sometimes takes possession of the Fairy-martin's nest by force of arms. They nest in spouts and Martins' nests in August and September, and in burrows in September. Eggs taken from burrow on October 4th.

36. STREPERA GRACULINA, *White.*

Although stray birds may be observed at any time, they first appear in force on the newly ploughed ground in April. We have not taken eggs, but they breed in the highest hills of the district. We have shot full fledged young birds on January 21st. Gould observed them only in small families, but here they are seen in flocks of 10 to 20, and at Mt. Wilson one of us has often noticed flocks of 100 or more making the mountain resound with their cries. They are very destructive in orchards and vineyards. Known locally as "Black Magpies."

37. STREPERA CUNEICAUDATA, *Vieill.*

Not generally seen in pairs in the centre of the district, but common at Cudgegong and Ilford in the southern part. They do not usually attack fruit when wild, but in a state of captivity eat it greedily. Gould attributes the metallic call of *clink, clink* to *S. arguta*, but, if this is not a mistake, the present

species has it too. Local names, "Rain-bird" and "Grey Magpie." Its call is supposed to be a prognostic of coming wet weather.

38. Gymnorhina tibicen, *Lath.*

A few nest in August, and we have known them begin as early as July 17th, but the greater proportion lay in October. A nest was taken at Springfield composed of the cut wire used by reaping and binding machines. They sing as much in autumn and winter as when nesting. Many do not breed every year, as we have noticed a flock of about 20 near the house always at Cullenbone. During the present autumn it increased to about 70. We have known them attack and kill old quail, and they frequently make a meal of young swallows. When washing, they wade into the water and stand in it flapping their wings.

39. Cracticus torquatus, *Lath.*

We have never known this bird impale its prey as the English shrike does, and indeed we have so few shrubs with strong thorns that it would find it difficult in most places to do so; but we have frequently observed it hanging its food in a fork. We have noted eggs from September 17th to middle of November, but as we have a note of young birds just fledged on September 14th, it must lay much earlier. Known as "Butcher-bird."

40. Cracticus robustus, *Lath.*

This handsome species is capricious in its occurrence. For some years they were common at Springfield, 3 miles east of Guntawang; these suddenly disappeared and were seen no more there. A flock of 7 lived about Beaudesert for a few weeks, and then left. One pair has lived for many years on a basaltic point at Guntawang. It is a daring bird, and attacks other birds even full grown. We once saw one killing an *Artamus sordidus*, a number of magpies, peewits, and soldier-birds looking on but not daring to interfere. In captivity it is dainty in its eating, and will not touch raw meat unless it is perfectly fresh and moist. It

talks and whistles well. Its most characteristic natural call resembles a prolonged *klo-klee-klo*, the first on D, the second its higher octave, and slurring back into the lower note on the third. It is a fine, bold, clear and liquid call, and worthy of the storm-cock himself. Eggs in October. Known as "Magpie Butcher-bird."

41. GRALLINA PICATA, *Lath.*

We once found a pair of these birds which had taken possession of an abandoned magpie's nest, and were there bringing up its brood. Eggs from September 16th to November 24th. Wades into the water to bathe.

42. GRAUCALUS MELANOPS, *Lath.*

We have noted both this bird and *Pteropodocys* using desert d nests of *Grallina.* The nest is frequently built on a dead tree without any shade. Eggs October 28th to December 7th, but as we have seen nearly fledged young on September 24, there can be no doubt that they breed much earlier. Locally known as "Blue-jay."

43. PTEROPODOCYS PHASIANELLA, *Gld.*

Sometimes rarely seen for years, at other times common all the year round, but usually leaves early in winter and returns in spring. For this reason it is known as "Spring-bird." Eggs in November and December, and we have noted a brood of young birds leaving the nest on January 29th.

44. LALAGE TRICOLOR, *Sw.* (= CAMPEPHAGA HUMERALIS, *Gld.*).

These birds arrive in September and leave in January and beginning of February. Eggs October 2nd to October 31st. The male sits in turn on the nest, and we have repeatedly observed that when he had sat as long as he thought proper, he left the eggs and, seeking out his mate, drove her to the nest.

45. PACHYCEPHALA GUTTURALIS, *Lath.*

Although the females of this species are often seen, the males are very rare, but this arises from shyness. They are apparently

aware that the beauty of their plumage renders them a desirable mark for the stone-throwing boy. We have not taken the eggs, nor are we able to state the times of its arrival and departure.

46. PACHYCEPHALA RUFIVENTRIS, *Lath.*

This species arrives in September, and most of them leave us in March, although we have noticed their plaintive call in the middle of May. A sudden noise, as the report of a gun, will always start them singing, and in this they resemble the Coach-whip bird, as also in their possessing ventriloquial powers. We have taken eggs from November 1st to December 7th. The male takes a turn in sitting on the eggs.

47. COLLYRIOCINCLA HARMONICA, *Lath.*

Builds in all manner of unexpected places, hollow posts, stumps, and even in banks where there is a hollow on the edge. For five years consecutively a pair has built in an old iron pot standing on a shelf in a carpenter's shop where work is frequently going on, at Cullenbone. On an occasion we took a set of eggs out of an old nest of *Pomatostomus temporalis.* Eggs in September, October, and November.

48. FALCUNCULUS FRONTATUS, *Lath.*

A rare bird, but when seen, many birds may be observed.

49. OREOICA CRISTATA, *Lew.*

This bird also possesses ventriloquial powers. Eggs in August and September.

50. RHIPIDURA ALBISCAPA, *Gld.*

We have seen an unfinished nest as late as December 15th. Gould says the eggs are invariably two, but one of us has seen three. Locally known as "Devil-bird." In bathing it hops into water and beats the water over itself, and then goes out, repeating the proceeding several times.

51. Sauloprocta motacilloides, *V. & H.*

Often poises itself over a calm waterhole with the fluttering motion of the kestrel. Eggs from September 2nd to December 7th. Known as "Wagtail." Sings all night.

52. Seisura inquieta, *Lath.*

This bird is rarer than the former, and the nest is generally found on the hills, but on two occasions in a Casuarina overhanging the river. It makes the grinding sound, from which it derives its local name of "Razor-grinder," both while on the wing and perched. Eggs from October to end of November.

53. Myiagra rubecula, *Lath.*

Rare.

54. Myiagra nitida, *Gld.*

Rare. Two nests have been seen in Casuarinas.

55. Micræca fascinans, *Lath.*

A very common species. Eggs October 3rd to December 14th. Locally known as "Jacky Winter." In the early morning when almost dark it sings a low sweet song.

56. Gerygone albigularis, *Gld.*

Sometimes ornaments the outside of its nest with the elytra of bright-coloured beetles. Eggs all through October and November. Local name "Native Canary."

57. Smicrornis brevirostris, *Gld.*

Eggs in November. Common.

58. Petræca Leggii, *Sharpe.*

Common all over the district.

59. Petræca Goodenovii, *Vig. & Horsf.*

Common all over the district.

60. Petræca phoenicea, *Gld.*

Common on the upland flats in winter, but in spring it retires to the wooded hills to breed. Eggs taken in November. All three species are known as "Robins."

61. Melanodryas bicolor, *Vig. & Horsf.*

These birds also retire to forests to breed in early spring, coming into the open country on February 7th. Eggs August 10th to October 4th. We have taken a set of eggs blotched with brown on the usual dull green ground.

62. Eopsaltria australis, *Lath.*

Eggs October 4th to December 7th. An egg in the possession of one of us is of a very vivid sea-green with red-brown blotches. Local name "Yellow Robin."

63. Menura superba, *Dav.*

This bird is found only in the scrubs on the Dividing Range at Cooyal. They build there on ledges of rock. Eggs in July.

64. Malurus cyaneus, *Lath.*

These birds, like the wagtail and reedbird, sing at night, especially in summer and when the moon shines. One of us has noted one flying persistently in front of a window, as if admiring its image in the surface. Eggs from September 2nd to December 7th, but we have seen young birds in the last week of August. Wades into water for bath.

65. Hylacola pyrrhopygia, *Vig. & Horsf.*

We have shot only one of these birds, at Biraganbil, but on several occasions afterwards we noticed a small flock at the same spot.

66. Sericornis frontalis, *Vig. & Horsf.*

So far as we know, this bird only occurs at Cooyal, and at Mullamuddy. A nearly finished nest was observed at the latter place on October 24th.

67. ACANTHIZA PUSILLA, *Lath.*

We have seen this bird only at Cooyal.

68. ACANTHIZA NANA, *Vig. & Horsf.*

Also shot only at Cooyal.

69. ACANTHIZA LINEATA, *Gld.*

Common in all parts of the district. The bronze cuckoos often lay their eggs in this bird's nest. Eggs August 1st to October 6th. Local name "Tomtit."

70. GEOBASILEUS REGULOIDES, *Vig. & Horsf.*

Much rarer than its congener. Eggs September 14th.

71. GEOBASILEUS CHRYSORRHŒA, *Q. et Gaim.*

Eggs in July, and on almost all through the year. Known locally as "Tomtit." Frequently foster-parent of bronze cuckoo. Wades into water for bath.

72. EPHTHIANURA ALBIFRONS, *J. & S.*

Eggs September 4th to November 7th. Although Gould, quoting E. P. Ramsay, says they arrive in New South Wales in September and October, we have always observed a few all winter, and it will be seen above that they breed early in September.

73. XEROPHILA LEUCOPSIS, *Gld.*

They pack in large flocks on the open uplands in autumn and winter, sometimes mingled with *Geobasileus chrysorrhœa.* Eggs July to November. Local name "Squeaker."

74. ORIGMA RUBRICATA, *Lath.*

Only seen on the sandstone at Cooyal and Goodaman, and in the brush at Mullamuddy. A deserted nest with one egg was taken at Cooyal in July, probably the last season's nest.

75. CHTHONICOLA SAGITTATA, *Lath.*

Eggs in September and October. Locally known as "Titlark."

76. ANTHUS AUSTRALIS, *Vig. & Horsf.*

Eggs August 1st to November 20th. Sometimes a set is met with differing from the ordinary type in having bold blotches on the usual ground; they then resemble the eggs of *Artamus superciliosus.* Known as "Ground-lark."

77. CINCLORAMPHUS CRURALIS, *Vig. & Horsf.*

A summer bird, rare here till 1884 and 1885, when it was extremely common. In 1886 few were seen, but they remained all winter, and we noticed them singing early in August. In 1887 they were rare still, although there were more than in the previous year, but in 1888 and 1889 we saw none at all, Eggs in October and November. Known as "Singing-lark."

78. CINCLORAMPHUS RUFESCENS, *Vig. & Horsf.* (=PTENOEDUS RUFESCENS).

The remarks on the previous species apply equally to this. Eggs August 1st to December 7th. A rare type of egg is pale flesh colour with a cap of deep chocolate. Known as "Singing-lark."

79. CALAMOHERPE AUSTRALIS, *Gld.*

Found on the river bank wherever a bed of reeds or bulrushes occurs. They arrive here in August, and lay from September 25th to December 16th. We have observed them feeding their young about the middle of March, and by the beginning of April they are all gone. They sometimes construct the nest in hanging branches of Casuarina or willow, as well as in reeds. They use wet and partly decomposed Typha leaves and water-weeds in building. Their song is heard all through the night in summer, especially on moonlight nights. Known as "Reed-bird."

80. MIRAFRA HORSFIELDII, *Gld.*

Rare.

81. ESTRILDA BICHENOVII, *Vig. & Horsf.*

First observed by us in 1886, and then seen all through the winter, and up till September in small flocks mingled with *Estrilda*

guttata. A pair took possession of an old nest of these birds for some days, but did not lay.

82. ESTRILDA TEMPORALIS, *Lath.*

Common on hills and rocky ground, but still rarer than *E. guttata*. We have not personally taken eggs. Called "Red-head."

83. ESTRILDA MODESTA, *Gld.*

Seen with *E. guttata* on a few occasions.

84. ESTRILDA GUTTATA, *Shaw.*

Very common. They breed all the year round. We have taken a set of eggs from an old *Pomatostomus* nest, and have also seen them build in hawks' nests. About Cullenbone they are very tame, and build in a prickly cactus past which people are continually passing; and also in a rose bush within a few feet of the kitchen door. They sleep in the half-built nest. When washing they wade into water. Locally known as "Diamond Sparrow."

85. ESTRILDA CASTANOTIS, *Gld.*

We are not sure whether this species was not introduced by having escaped from captivity, but the birds breed in the immediate vicinity of Mudgee in September and October.

86. DONACICOLA CASTANEOTHORAX, *Gld.*

Only one specimen shot.

Besides the above finches, we once observed a small flock of red finches feeding on grassland, but were unable to shoot for identification.

87. CINCLOSOMA PUNCTATUM, *Lath.*

Not uncommon on stony hill-sides. Eggs taken on August 20th withlarge young ones in them.

88. PTILONORHYNCHUS VIOLACEUS, *Vieill.* (= P. HOLOSERICEUS, *Kuhl.*)

One or two shot at Cooyal in a fruit garden. It has decided powers as a mimic.

89. MIMETA VIRIDIS, *Lath.*

A summer visitant, arriving here on August 1st and staying to middle of May. Its sweet rolling song is only heard while it is breeding. It breeds in Casuarinas along the river-bank. It is very destructive in orchards, being especially partial to cherries and mulberries. Known as "Green Thrush."

90. CORCORAX MELANORHAMPHUS, *Vieill.*

We have taken the eggs in September. The young birds have brown irides instead of crimson as in the adult. Shares the name of "Black Magpie" with *Strepera graculina*, and that of "Dollar-bird" with *Eurystomus.*

91. STRUTHIDEA CINEREA, *Gld.*

The eggs of the peewit were apparently described by Gould for those of this bird. They are faint blue with intensely black specks. The only eggs we have taken, and kept a note of date, were three belonging to a family of four at Cullenbone, but it breeds also at Springfield and Guntawang. It seems to be a wandering bird. About Cobbora they are known as "Twelve Apostles," a title shared by *Pomatostomus.*

92. CORONE AUSTRALIS, *Gmel.*

Breeds in the district.

93. CORVUS AUSTRALIS, *Vig. & Horsf.*

Breeds in district. Local native name is "Waggalin."

94. POMATOSTOMUS TEMPORALIS, *Vig. & Horsf.*

Very common. We fancy that more than one couple lay in the same nest. On one occasion, in taking a nest, one of us saw seven birds fly out, three eggs being in the nest. We have taken as many as eight eggs in one nest. Dirty white specimens without any markings are not uncommon, and the shape is very variable. Eggs July to March 29th. Known by an immense variety of trivial names, the local native name being "Kidgeragah." Fond of taking a bath in the dust by the road-side.

95. Pomatostomus superciliosus, *Vig. & Horsf.*

Rarer than the preceding species. Eggs in September and October.

96. Meliornis Novæ-Hollandiæ, *Lath.*

We have seen only a single pair of these birds.

97. Ptilotis leucotis, *Lath.*

Not uncommon from July to January, when the Eucalypts are flowering. Like all of the Meliphagidæ which we have observed, this bird takes its bath by dashing into the water almost as rapidly as a kingfisher. We have not taken eggs of this species.

98. Ptilotis auricomis, *Lath.*

Rare, but breeds in the district.

99. Ptilotis penicillata, *Gld.*

Breed in the Casuarina trees on the river banks. Eggs from September to November. Young seen on April 28th.

100. Ptilotis fusca, *Gld.*

Common everywhere. Eggs September to November or later.

101. Ptilotis chrysops, *Lath.*

Common. All five *Ptilotes* are locally known as "Gold-eyes."

102. Plectorhyncha lanceolata, *Gld.*

One of us shot a solitary bird.

103. Meliphaga phrygia, *Lath.*

Not common here till 1885 and 1886, when large numbers were observed in July feeding on the white-box blossom (*Eucalyptus hemiphloia*), and young birds not able to fly were observed in September. One of us took two sets of eggs and heard of another being taken, so that there can be no doubt as to their breeding.

104. Anthochæra carunculata, *Lath.*

Common all over the district, but most plentiful in July, when the red-flowering ironbark (*E. sideroxylon*) is in blossom, at which time the succeeding species also is most abundant. Called "Wattle-bird" or "Gill-bird."

105. Philemon corniculatus, *Lath.*

Eggs taken in November. Local name "Leather-head." Native name "Quállarogong."

106. Philemon citreogularis, *Gld.*

A young bird shot eating fruit on February 15th, 1886, and a large flock observed by us at Cullenbone on November 12th same year, are all we have seen of this species in the district.

107. Acanthorhynchus tenuirostris, *Lath.*

This species is rare in all parts of the district except at Cooyal where it is extremely common. It feeds on mistletoe berries, honey, and small insects, and is very commonly noticed in *Acacia discolor*, when that shrub is in bloom.

108. Myzomela nigra, *Gld.*

Two males were shot out of a large flock feeding on the blossoms of Robinia at Springfield in September. A single female was seen by us at Guntawang in March, and one at Cullenbone on May 1st. The bird is a western species, we believe, and had far overlapped its ordinary bounds in coming here.

109. Entomyza cyanotis, *Swains.*

Sometimes this bird makes a depression on top of the nest of a *Pomatostomus* to lay in, but more usually it goes inside. It very rarely builds a nest of its own, but when it does, it is of the same type as that of the Leather-head. Eggs November 2nd. It is locally known as "Blue-head" and "Green-baker," the latter name being probably a corruption of Green-back or backer, in allusion to its olive-yellow back.

110. Melithreptus brevirostris, *Vig. & Horsf.*

Not known to breed. Usually but seldom seen, though sometimes coming in vast flocks.

111. Melithreptus lunulatus, *Shaw.*

One of us has seen this bird feeding the young of *Cuculus pallida.*

112. Myzantha garrula, *Lath.*

Breeds from August 1st to January or even later. Very plentiful and very destructive to fruit, especially grapes. Trivial name "Soldier-bird," the native name "Kwee-kwee-gah."

113. Dicæum hirundinaceum, *Shaw.*

We have not taken eggs, but one of us took an old nest in an *Exocarpus* tree on Beaudesert hills. Fond of cherries and strawberries.

114. Zosterops cærulescens, *Lath.*

We do not think this bird breeds in the district. It arrives in the height of the grape season, and causes much loss by pecking the fruit.

115. Climacteris scandens, *Temm.*

Common. A pair builds every year at Cullenbone under the eaves, on top of a brick wall. Eggs from September 16th to December 7th. Some nests taken in hollow trees were lined with opossum fur.

116. Climacteris leucophæa, *Lath.*

Eggs September to November.

117. Sittella chrysoptera, *Lath.*

We have not taken eggs of this species.

118. Cuculus pallidus, *Lath.* (= Cacomantis pallida).

The majority of individuals arrive in September and depart before the frosts, in March; but a few remain all the winter as we

have noted them and heard the call from April to August. The commonest call is part of a chromatic scale rising from D to A. The eggs are often found in the nests of various species of *Ptilotis*.

119. CUCULUS FLABELLIFORMIS, *Lath.* (=CACOMANTIS FLABELLIFORMIS).

Seen from August to April.

120. MESOCALIUS PALLIOLATUS, *Lath.*

One specimen is all we have shot.

121. CHALCITES PLAGOSUS, *Lath.*

Eggs taken in nests of *Malurus* and *Geobasileus* November 2nd to December 9th. Flocks were seen as late as June 16th.

122. CHALCITES BASALIS, *Horsf.*

Eggs taken December 9th in nest of *Malurus*.

123. SCYTHROPS NOVÆ-HOLLANDIÆ, *Lath.*

One specimen shot by the late Mr. H. Thurston at Rylston is preserved in the Mechanics' Institute, Mudgee.

124. CACATUA GALERITA, *Lath.*

These are rare in the central parts of the district where pastoral pursuits are followed, but in the outlying agricultural districts common. We have known nests in white gums on river flats at Gooree and Broombee.

125. CACATUA ROSEICAPILLA, *Vieill.*

Once not uncommon but now extinct in the district.

126. CALYPTORHYNCHUS BANKSII, *Lath.*

127. CALYPTORHYNCHUS SOLANDRI, *Temm.*

These two birds are extremely rare.

128. CALYPTORHYNCHUS FUNEREUS, *Shaw.*

Common at Cooyal, but we do not know of their breeding. We have also seen them at Goodaman and at Guntawang.

129. Calopsittacus Novæ-Hollandiæ, *Gmel.*

Usually a rare bird, but on October 3rd, 1886, numbers appeared; and many, apparently, had not time to seek hollows for nesting, and were seen to alight on the ground and deposit an egg. On the borders of the district they are common. Eggs from the nest December 7th.

130. Aprosmictus scapulatus, *Bechst.*

These birds come in numbers to Cooyal to feed on the ripe mistletoe berries in March and April, and stray pairs are often seen all over the district. We have no evidence of their breeding here.

131. Aprosmictus erythropterus, *Gmel.*

Some have been shot at Eurunderee eating peaches, and they are known to breed at Cobbora. Local name "Bellawing."

132. Platycercus Pennantii, *Lath.*

Common in the winter months. Breeds at Cooyal in December. Known as "Blue Lowry."

133. Platycercus eximius, *Shaw.*

Common all over the district. Breeds in November to December 7th. Like all the parrots, it wades into the water to wash.

134. Psephotus hæmatonotus, *Gld.*

Very common, living in flocks. Breeds from 27th September to the end of November. Known as "Ground-parrot."

135. Euphema pulchella, *Shaw.*

Frequent well grassed stony hills, feeding on kangaroo grass (*Anthistiria ciliata*). They breed in the hills, but we have not taken eggs.

136. Melopsittacus undulatus, *Shaw.*

Once very common, and then not seen again, but coming in vast flocks for the last three or four years. Breeds in December. Native name "Budgherighar."

137. LATHAMUS DISCOLOR, *Shaw.*

Arrives in April and May to feed on the gum-blossom.

138. TRICHOGLOSSUS NOVÆ-HOLLANDIÆ, *Gmel.*

Visits the district to feed on gum-blossom, especially in spring when *Eucalyptus sideroxylon* flowers.

139. TRICHOGLOSSUS CONCINNUS, *Shaw.*

Breeds in the district, but the flocks follow the gum-blossom. Known as "Green-leek" and "Musk-paroquet."

140. TRICHOGLOSSUS PUSILLUS, *Shaw.*

The same remarks apply to this species, and the same local names are applied to it.

141. LEUCOSARCIA PICATA, *Lath.*

A few specimens procured at Cooyal.

142. PHAPS CHALCOPTERA, *Lath.*

Eggs taken on December 28th. Native name "Wabba."

143. GEOPELIA TRANQUILLA, *Gld.*

Common.

144. GEOPELIA CUNEATA, *Lath.*

Rarer than the preceding species.

145. TURNIX VARIUS, *Lath.*

Common. Breeds in November. One of its calls is a booming sound not unlike that of *Ninox boobook.*

146. TURNIX VELOX, *Gld.*

Rare. We have taken eggs on December 11th.

147. TURNIX PYRRHOTHORAX, *Gld.*

Breeds in December.

148. COTURNIX PECTORALIS, *Gld.*

Common. Breeds here.

149. SYNOICUS AUSTRALIS, *Lath.*

Breeds here.

150. Excalfatoria australis, *Gld.*

Rare. Known as "King-quail."

151. Dromaius Novæ-Hollandiæ, *Lath.*

Once common, but since the settlement of the district only appearing as a visitor, especially in dry years.

152. Eupodotis australis, *Gray.*

A summer visitant.

153. Œdicnemus grallarius, *Lath.*

Common. Breeds in August.

154. Lobivanellus lobatus, *Lath.*

Common. Breeds in August.

155. Sarciophorus pectoralis, *Cuv.*

These birds live in large flocks up till the middle of July, when they separate into pairs. They are very regular in their time of nesting; eggs taken from about the 1st to 14th August. They pack again on November 19th.

156. Aegialitis nigrifrons, *Cuv.*

Eggs taken from October 1st to November 19th. Young seen October 30th and on to December. They occasionally, as if for amusement, take lofty flights, wheeling about for some time and then descending to the earth like stones.

157. Erythrogonys cinctus, *Gld.*

These sometimes visit us during floods in autumn—April and May usually, young birds of the year being among the number. These may be distinguished by their dark brown instead of black heads. On arrival they are usually in poor condition, but after a week or two on the flooded ploughed lands they become balls of fat.

158. Tringa acuminata, *Horsf.*

These arrive in October, young birds being of the number. They soon become very fat.

159. Gallinago australis, *Lath.*

Generally a few arrive on September 1st, but the main body come in the middle of the month, and they remain up to February 1st.

160. Rhynchæa australis, *Gld.*

Rarer than the last bird.

161. Geronticus spinicollis, *Jameson.*

These arrive in thousands in dry years, in October and November, many young birds being among them, their necks being clothed with white feathers, and their backs brown instead of bronze. Locally known as "Hard-times."

162. Threskiornis strictipennis, *Gld.*

Another occasional visitor, but only seen in pairs. We have shot them in April and January. Besides these two Ibises, we have seen one specimen of *Ibis falcinellus*, Linn., shot at Coolah, but as that is a little beyond the limits of our district as before described, we have not included it in our list.

163. Platalea melanorhynca, *Reich.*

Occasionally a few pairs visit us in January and February, as does the succeeding species.

164. Platalea flavipes, *Gld.*

165. Grus australasianus, *Gld.*

A visitant observed in December and March.

166. Mycteria australis, *Lath.*

A rare accidental visitant.

167. Ardea pacifica, *Lath.*

168. Ardea Novæ-Hollandiæ, *Lath.*

Both species are common and breed in the district. On one occasion one of us saw seven young birds of this species perched round one nest.

169. HERODIAS ALBA, *Linn.*

Rare.

170. NYCTICORAX CALEDONICUS, *Lath.*

Breeds with us, but we have no record of dates.

171. BOTAURUS POICILOPTERUS, *Wagl.*

A specimen was shot by Mr. H. Thurston.

172. ARDETTA MINUTA, *Linn.*

We have seen only one specimen, shot by Mr. E. Garling at Springfield.

173. PORPHYRIO MELANOTUS, *Temm.*

Rare.

174. GALLINULA TENEBROSA, *Gld.*

Very common. Breeds.

175. FULICA AUSTRALIS, *Gld.*

Not so common as *Gallinula.* Breeds.

176. PARRA GALLINACEA, *Temm.*

One was shot by Mr. H. Thurston.

177. HYPOTÆNIDIA PHILIPPENSIS, *Linn.*

Eggs taken in hayfield October 26th, and young birds just hatched seen on 5th November.

178. CYGNUS ATRATUS, *Lath.*

Rare, but once quite plentiful. Eggs October 30th. Young out November 3rd.

179. ANSERANAS MELANOLEUCA, *Lath.*

We have seen two specimens shot at Beaudesert; the species also occurs at Coolah.

180. BRANTA JUBATA, *Lath.*

Common. Breeds.

181. DENDROCYGNA VAGANS, *Eyton.*
Rare.

182. STICTONETTA NÆVOSA, *Gld.*

183. ANAS SUPERCILIOSUS, *Gmel.*
Common, and breeds. Some well-authenticated cases of hybrids between this species and the domestic duck have occurred.

184. ANAS CASTANEA, *Eyton.*
Common, breeding in the district. Gould describes the eye of the adult male as hazel, but we have noted it bright carmine.

185. SPATULA RHYNCHOTIS, *Lath.*
Rare, usually occurring in pairs.

186. NYROCA AUSTRALIS, *Gld.*
One or two shot at Beaudesert and at Reedy Creek.

187. BIZIURA LOBATA, *Shaw.*
Seen in small numbers in the deeper reaches of the Cudgegong

188. PODICEPS NOVÆ-HOLLANDIÆ, *Steph.* (=P. GULARIS, *Gld.*).
Common all over the district in river and creeks.

189. LARUS PACIFICUS, *Lath.*
A large number of these birds appeared, with a few of the following species, on the river at Beaudesert, and on dams, especially a sludge dam, at Canadian Lead in 1885 and 1886, about Christmas.

190. LARUS NOVÆ-HOLLANDIÆ, *Steph.*

191. PLOTUS NOVÆ-HOLLANDIÆ, *Gld.*
Rare. In the stomachs and hock joints of these birds we have found quantities of worms.

192. GRACULUS MELANOLEUCUS, *Vieill.*
Common.

193. GRACULUS STICTOCEPHALUS, *Bp.*
Common.

194. PELECANUS CONSPICILLATUS, *Temm.*

An occasional visitant.

In addition to the 194 species above recorded, the English sparrow has become naturalised in the town of Mudgee, and is rapidly spreading over the country. It was quite unknown until some little time after the completion of the railway. A number of English song birds were procured, and set at liberty near Mudgee, but the only one which succeeded in getting a footing was the Skylark. We have been told that they are often heard singing about Broombee, but do not know if it is a fact. At Guntawang, however, a pair appeared, and remained for some time apparently looking for a suitable nesting place, but after a few days we saw no more of them.

Besides these, private individuals have turned out Pheasants, Californian Quail, and Partridges, but we have no evidence that they have spread. Some of the country on which they were turned out was much traversed by us, but we saw no trace of them.

Of the 194 above-named species, 17 belong to the western side, and 13 to the coast district. 127 species live constantly and breed in the district; 15 visit the district to breed, 10 are regular visitors but do not breed; 33 are occasional visitors; 7 are strays, and 1 visits occasionally but was once plentiful, while another once plentiful, is now extinct in the district.

Arranged according to their natural orders there are :—

ACCIPITRES...........	16 = 8·1	per cent of the whole.	
PASSERES.............	100 = 51·5	„	„
SCANSORES............	23 = 11·8	„	„
COLUMBÆ.............	4 = 2·1	„	„
GALLINÆ..............	6 = 3·1	„	„
STRUTHIONES.........	2 = 1	„	„
GRALLÆ...............	25 = 12·9	„	„
ANSERES......	17 = 8·8	„	„

Of the Passeres, 19 belong to the tribe Meliphagidæ; while 17 out of the 23 Scansores belong to Psittacidæ.

A comparison of the Mudgee birds with those given as Cumberland birds in Mr. A. J. North's list (P.L.S.N.S.W. Vol. III., 2nd Ser., p. 1773), and with the birds of New South Wales and Australia, as given in Dr. Ramsay's list (l.c. Vol. II., p. 177) will perhaps be of interest.

Orders.	Australia.		N. S. Wales.		Cumberland.		Mudgee.	
	Species.	Per-centage.	Species.	Per-centage.	Species.	Per-centage.	Species.	Per-centage.
Accipitres..........	36	4·8	33	7·6	20	8·4	16	8·1
Passeres............	393	52·5	178	41·2	122	51·2	100	51·5
Scansores...........	83	11·1	50	11·6	23	9·6	23	11·8
Columbæ............	26	3·4	14	3·1	11	4·6	4	2·1
Gallinæ.............	18	2·4	11	2·5	6	2·5	6	3·1
Struthiones........	4	·5	2	·4	0	0	2	1
Grallæ..............	84	11·2	67	15·6	26	10·9	25	12·9
Anseres.............	100	13·3	74	17·2	30	12·6	17	8·8
Total species.....	744		429		238		194	

In making out the numbers and percentage of Cumberland birds from Mr. North's list we have included those he considers strays, as we had done so also in the list of Mudgee birds.

REVISION OF THE GENUS *HETERONYX*, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem. Linn. Soc. N.S.W.

Part III.

The *Heteronyces* still remaining to be treated form the 2nd group of the 3rd of the main divisions into which I have cut up the genus for the convenience of this memoir, but which divisions it will be remembered I do not set forth as at all capable of being regarded as sub-genera, being well aware that if such a grouping were possible (which it has not been to me) it would have to follow very different lines. This (my Section III.) consists of species having the summit of the labrum overtopping the plane of the clypeus, and I subdivide it into two groups distinguished by having 8- and 9-jointed antennæ respectively. The former of these groups was treated of in Parts I. and II. of my revision, and I have now to enter upon the revision of the 2nd group. As in the case of the former I again subdivide the group into two subgroups, one having the claws bifid, the other having them appendiculate. The present Part of the Revision deals with the species having bifid claws. As a rule there is at most not much difference between the claws on the various tarsi,—but nevertheless to make the characters more reliable I base them in each instance on the claws of the hind tarsi. Strictly speaking the claws of all *Heteronyces* are appendiculate and the differences among them are of degree only. The differences consist chiefly in the extent to which the basal piece of the claw is angularly produced, or dentate, at its inner apex. In general, the larger the basal piece in proportion to the apical the more pronounced is the inward projection of the former, so that there are a certain number of species in which,

this inward projection being quite pronounced, while the apical piece is very small, these two (*i.e.*, the inward projection or "tooth" of the basal piece and the apical piece) are not very different from each other in size and the claw has a bifid appearance. Although it does not appear to me really accurate to call this form of claw "bifid," nevertheless as it has been so called by former describers I have thought it better to retain the word in the Latin diagnoses.

I have also included in this subgroup such species (they are very few) as have the claws *abnormal*, the appendiculation being extremely minute and placed close to the tip of the claw, so that the apical piece is only a quarter or thereabouts of the size of the basal piece. Thus, the following will be the definition of the hind claws in the species forming this subgroup:—"the basal piece ending internally in a well defined process at least half as large as the apical piece, or the appendiculation quite minute and apical."

Tabulation of the species of *Heteronyx* having the labrum overtopping the plane of the clypeus, the antennæ 9-jointed, and the claws as specified above.

A. Hind coxæ not, or scarcely, shorter than lateral suture of metasternum..........

B. Anterior tibiæ distinctly tridentate externally................................

C. Surface of elytra normal..............

D. Middle lobe of trilobed outline* much narrower than the lateral lobes.................................. *Darwini*, Blackb.

DD. Middle lobe of trilobed outline very little narrower than the lateral lobes .... *incola*, Blackb.

CC. Surface of elytra with wide feeble costæ ....

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* *Vide antea* p. 139.

D. Trilobed outline of head well defined; middle lobe narrow; club of antennæ black.......... *potens*, Blackb.

DD. Trilobed outline of head scarcely apparent; middle lobe very wide; club of antennæ pale *aridus*, Blackb.

BB. Uppermost tooth on external margin of front tibiæ reduced to a mere nick on the outline.................. *bidentatus*, Blackb.

AA. Hind coxæ decidedly shorter than lateral suture of metasternum........

B. Club of antennæ black or nearly so.. ..

C. Puncturation of prothorax sparse and lightly impressed.......... ....

D. Middle lobe of trilobed outline of head from all points of view projecting beyond the lateral lobes which are scarcely defined *aphodioides*, Blanch.

DD. Middle lobe of trilobed outline of head not appearing to project beyond the lateral lobes which are well defined......... *incultus*, Blackb.

CC. Puncturation of prothorax strong and close .... *aspericollis*, Blackb.

BB. Club of antennæ pale in colour ......

C. Relation of labrum to clypeus such that the outline of the head is distinctly trilobed from a certain point of view................. ......

D. Middle lobe of trilobed outline appearing rounded...............

E. Appendiculation of claws very minute and close to apex..... *lividus*, Blackb.

EE. Appendiculation of claws not particularly minute and close to apex..................

F. Prothorax closely (*vide ant.* p. 139) punctured..........

G. Joints 1 and 2 of hind tarsi equal................ *subfuscus*, Macl.

GG. Joint 2 of hind tarsi longer than 1........... *borealis*, Blackb.

FF. Prothorax sparingly punctured........... .... *sparsus*, Blackb.

DD. Middle lobe of trilobed outline appearing sharply triangular *acutifrons*, Blackb.

CC. Relation of labrum to clypeus such that the outline of the head is not distinctly trilobed............ *rotundifrons*, Blackb.

Heteronyx potens, sp.nov.

Sat brevis; sat convexus; postice vix dilatatus; minus nitidus; obscure æneo-niger; pilis pallidis parum perspicuis minus crebre vestitus; capite (clypeo sat crebre ruguloso excepto) prothoraceque sparsius leviter subcrasse, elytris (his substriatis) sparsim leviter crasse, pygidio subobsolete, punctulatis; labro clypeum anguste leviter superanti; antennis 9-articulatis; unguiculis bifidis; coxis posticis metasterno vix brevioribus. [Long. $2\frac{1}{2}$-$3\frac{1}{4}$, lat. $1\frac{2}{5}$-2 lines.

The "trilobed outline" of the head is fairly well-marked, the middle lobe being about as long, but less than half as wide, as each of the lateral ones.

The upper edge of the turned-up labrum rises slightly above the surface of the clypeus; the latter is concave in front with its

reflexed margin obsolete in the middle and its surface nearly evenly continuous with that of the rest of the head; the clypeal suture is marked by a faint wavy line. The prothorax is a little more than half again as wide as long, its base a little less than half again as wide as its front which is gently concave with sharp but little prominent angles; the sides are very gently arched; the hind angles (viewed from above) appear right angles, but not sharply so; the base is bisinuate, being moderately lobed in the middle; the surface is faintly impressed on the median line. This is one of the few species of *Heteronyx* in which the elytra have some appearance of being punctulate-striate; on careful inspection however it is seen that the lightly impressed punctuation (which is rather small and close near the suture becoming coarse, more sparing and sub-obsolete externally) is not really linear in arrangement but appears so only through the presence of some very obscure longitudinal costæ on which the punctures are more faint than on the general surface; nevertheless there is certainly a *tendency* towards the kind of sculpture that prevails in *Scitala* and other genera; the lateral fringe is not continued round the apex and there is little or no defined membranous border; the costa nearest to the lateral margin (which is practically non-existent till close to the apex) becomes well-defined *at* the apex, and is bent round just within the apex and reaches across towards the suture. The sculpture of the underside is very obscure, consisting on a minutely coriaceous ground of rather large scarcely impressed punctures. The hind coxæ are scarcely shorter than the metasternum. The ventral series consist of hairs and are moderately well-defined. The three teeth on the anterior tibiæ are acute, but the uppermost is very small. The pilosity of the upper surface is much more conspicuous on the head and prothorax, where it has a golden tinge, than on the elytra.

Resembles *H. fortis* (in Sect. I.), and *H. submetallicus*, but differs widely from either in important structural characters. Immature specimens are more or less ferruginous, with a slight metallic tone. The pilosity is very deciduous. The black antennæ of this and some of its allies are characteristic. The produced apex of the

basal piece of the hind claws is slender and more than half as large as the entire apical piece.

Apparently common. I have seen specimens from N. S. Wales, Victoria, and S. Australia.

H. APHODIOIDES, Blanch.

The information regarding this species supplied by its place in the preceding tabulation added to that furnished in the original description will render it easy of identification. The insect to which I apply the name (and to which Sir W. Macleay also applies it), differs from the description a little in the puncturation of the prothorax which is stated by Blanchard to be "deep," but I find that the punctures although rather *large* are only lightly impressed. *H. aspericollis* has a deeply punctured prothorax, but also has the pygidium strongly punctulate, which in *aphodioides* is said to be "scarcely punctured." If *H. aphodioides* be before me at all it is certainly I think the insect to which I apply the name, and which differs from the description so slightly that I am unwilling to give it a new name. It may be added that some specimens have a faint metallic tinge, and that the produced apex of the basal piece of the hind claws is very little smaller than the entire apical piece. The costæ on the elytra (mentioned by Blanchard) are in reality only very slight,—resembling those of *H. potens* (to which this species is clearly allied)—but distinguish it and some other species from nearly all the genus.

N. S. Wales, apparently common.

H. INCULTUS, sp.nov.

Brevis; sat latus; postice dilatatus; minus nitidus; niger, ore pedibusque piceis; pilis sat elongatis pallidis vestitus; leviter punctulatus; labro clypeum sat anguste sat fortiter superanti; antennis 9-articulatis; unguiculis bifidis.

[Long. $3\frac{1}{2}$, lat. $1\frac{3}{4}$ lines.

The part of the labrum overtopping the clypeus is narrow and the sides of the clypeus are considerably reflexed so that the "trilobed outline" of the head appears well-defined with the middle lobe less than half as wide as the lateral ones and equal to them in length. The clypeus forms a nearly even surface with the rest of the head and its suture is very feeble. The prothorax exactly resembles that of *H. potens*, except in having the hind angles more rounded off and its surface without any indication of a dorsal channel which in *H. potens* seems to be invariably indicated,—at least in the middle of the disc. In other respects the description of *H. potens* may be read as applying to this species with the following exceptions;—the elytra are considerably more pilose and their sculpture though still lightly impressed is very evidently better defined; the hind coxæ are considerably shorter than the metasternum. There is also a marked difference in shape between the two insects, *H. incultus* being in every way a more convex species than *H. potens;* viewed from the side the upper outline of the elytra appears in the former as a well-marked gentle arch evidently *rising* from the scutellum to about the middle of its length, while in *H. potens* it runs backward nearly on a level till it deflects at the posterior declivity. The black club of the antennæ distinguishes this from the majority of species of *Heteronyx*. In the hind claws the produced apex of the basal piece is decidedly stouter, and not much shorter, than the entire apical piece.

Near Adelaide; Sir W. Macleay's collection possesses a specimen attributed to N.S.W. I have seen only these two examples.

H. asperICOLLIS, sp.nov.

Elongatus; postice vix dilatatus; sat nitidus; niger; pilis elongatis rufis vestitus; supra crebre rugulose sat crasse punctulatus; antennis basi, palpis, tarsisque, rufescentibus; labro clypeum late minus fortiter superanti; antennis 9-articulatis; unguiculis breviter bifidis. [Long. $2\frac{3}{5}$, lat. $1\frac{1}{5}$ lines.

The part of the labrum overtopping the clypeus is wide and but slightly elevated, while the sides of the clypeus are well-reflexed, so that the "trilobed outline" of the head appears only moderately defined, with the middle lobe half as wide, and scarcely so long, as the lateral lobes. The clypeus does not form a continuous surface with the rest of the head from which it is separated by a well-defined sub-angulated suture; its puncturation is finer and closer than that of the rest of the surface. The sculpture of the upper surface is in all respects extremely similar to that of *H. nigellus*, Er., albeit the puncturation of the prothorax is a little closer. The prothorax is a little more than half again as wide as long, its base not much more than a quarter again as wide as the front which is only moderately concave with angles little produced and rather blunt; the sides are gently arched, the hind angles viewed from above appear distinct and almost rectangular; the base is slightly bisinuate and but feebly lobed hindward. The lateral fringe of the elytra is normal, the apical membrane of the same scarcely apparent. The hind coxæ are much shorter than the metasternum and not much wider than the 2nd ventral segment. The puncturation of the under surface is large, sparing, and lightly impressed except on the sides of the metasternum where it is fairly close and deep; on the ventral segments it is very ill-defined. The ventral series consist of long testaceous hairs. The hind femora are moderately wider than the intermediate and have their inner apical portion but little prominent and obtusely angulate. The anterior tibiæ are like those of *H. potens*. The apical piece of the hind claws is scarcely a quarter the size of the basal piece and is very little larger than the produced apex of the latter.

Wagga Wagga, N.S. Wales; in the collection of Sir W. Macleay.

H. ARIDUS, sp.nov.

Sat elongatus; postice minus dilatatus; subnitidus; supra subtilius leviter, crebrius (clypeo paullo crassius) punctulatus;

piceo-niger, vix bronzeo-*micans; labro et clypei lateribus, rufescentibus; palpis antennis pedibusque testaceis vel rufis; sutura clypeali et prothoracis margine antico pilis erectis fimbriatis; corpore subtus parce sat longe hirsuto; labro clypeum late leviter superanti; antennis 9-articulatis; unguiculis bifidis.

[Long. $2\frac{1}{5}$, lat. 1 line.

The "trilobed outline" of the head is scarcely defined owing to the anterior concavity of the clypeus being filled by the labrum so that from the most favourable point of view (very far back) the outline appears as a continuous scarcely bisinuate curve, with the middle lobe scarcely narrower than the lateral ones. The plane of the clypeus is quite distinct from that of the rest of the head, the clypeal suture being well marked and angulated. The anterior concavity of the clypeus is very wide and very slight. The prothorax is a little less than twice as wide as long, its base rather less than half again as wide as its front, which (viewed from above) is almost truncate with scarcely prominent angles; the sides are gently arched, but (viewed from above) appear scarcely divergent from base to middle, there subangulated, thence obliquely convergent; the hind angles appear from above distinct but obtuse, and the basal outline is gently convex all across. The sculpture of the elytra resembles that in *H. potens*, but the puncturation is a little finer, deeper, and closer, and the lateral costæ are scarcely existent—those on the disc also being even feebler than in *potens*. The hind coxæ are quite as long as the metasternum; the puncturation of the latter being faint but not fine, much closer at the sides than in the middle—of the former almost obsolete except near the lateral margins where it is very sparse and faint. The ventral segments are scarcely punctured at all, the ventral series hardly distinguishable among the similar long hairs scattered thinly over the ventral surface. The hind femora are considerably wider than the intermediate (as in *H.*

* This word (though not classical) seems necessary, as "æneus" is constantly used to express "brassy."

potens), their inner apical angle scarcely defined. The three external teeth of the anterior tibiæ are fairly strong, the uppermost about half as large as the intermediate one. The apical piece of the hind claws is about a quarter the size of the basal and scarcely twice as large as the produced apex of the latter. The bifid apex of the claws is much more minute than in *H. potens*.

Basin of Lake Eyre.

H. BIDENTATUS, sp.nov.

Sat elongatus; postice vix dilatatus; minus nitidus; fusco-testaceus; pilis adpressis minus brevibus sat dense vestitus; capite pygidioque (his pilis erectis plus minus vestitis) sparsius subtilius, prothorace elytrisque crebre subtiliter, punctulatis; labro clypeum late fortiter superanti; antennis 9-articulatis; unguiculis bifidis. [Long. 3, lat. $1\frac{2}{5}$ lines.

The "trilobed outline" of the head is scarcely marked, owing to the strong projection of the labrum and the almost obsolete projection of the sides of the clypeus; in the position most favourable for showing a "trilobed outline" the appearance is that of an almost continuous curve suddenly bulging out in the middle—the portion thus bulging out being nearly as wide as the lateral portions. The clypeus does not quite form an even surface with the rest of the head, from which it is separated by a feebly angulated suture; its front is scarcely concave and not distinctly margined. The prothorax is twice as wide as it is long; its base about half again as wide as its front, which (viewed from above) is bisinuate, with feeble angles scarcely produced; it is widest a little in front of the base, its sides being strongly arched, its basal angles scarcely defined from any point of view; its base very feebly convex all across. The elytra show no striation beyond a feebly traceable sutural stria (probably quite obsolete in some examples), their transverse wrinkling quite obsolete, their puncturation very fine and close (a little

more so than in *H. piceus*, Blanch.), their lateral fringe normal, their apical membrane obsolete. The hind coxæ are quite as long as the metasternum, the puncturation of both these being decidedly close and fairly strong at the sides, while in the middle of the latter and about the antero-internal part of the former it is coarse and sparse. The ventral segments are almost lævigate, the ventral series being very conspicuous and consisting of stout bristle-like hairs. The hind femora are very wide (quite double the intermediate), their inner apical angle obtuse and little prominent. The lower two external teeth of the front tibiæ are very strong and sharp—the uppermost is represented by a mere nick on the outline. The apical piece of the hind claws is evidently less than half as large as the basal piece and decidedly larger than the produced apex (which is truncate at the end) of the latter.

N.B.—The intermediate joints of the antennæ are so crowded together, small, and obscure, that they are very difficult to count with certainty.

Western Australia; taken by E. Meyrick, Esq.

H. Darwini, sp.nov.

Sat elongatus; convexus; postice leviter dilatatus; sat nitidus; niger, antennis palpisque testaceis; pilis testaceis (et adpressis et erectis) vestitus; supra subcrasse minus crebre punctulatus; labro clypeum anguste fortiter superanti; antennis 9-articulatis; unguiculis bifidis; coxis posticis metasterno haud brevioribus.

[Long. $5\frac{2}{5}$, lat. $1\frac{4}{5}$ lines (vix).

The head closely resembles that of *H. nasutus*, Blackb. The prothorax is $\frac{2}{3}$ again as wide as long, its base scarcely $\frac{2}{3}$ again as wide as its front which is moderately concave with angles but little produced; the sides are gently arched; the hind angles viewed from above appear fairly defined but obtuse; the base is lightly bisinuate, being moderately lobed in the middle. The puncturation of the upper surface is not deep but rather coarse,

and somewhat even but becoming slightly less coarse and sparse continuously from the clypeus hindward; on the pygidium, however, it is decidedly faint and sparse. The elytra have no distinct trace of striation; their transverse wrinkling is well defined, their lateral fringe normal, their apical membrane very obscure. The hind coxæ are not shorter than the metasternum. The ventral series consist of stout bristles but are not very conspicuous owing to the presence of numerous fine long hairs on the ventral segments, and they appear to be very deciduous only one of several specimens before me having them in full complement. The metasternum and hind coxæ are punctured rather coarsely and closely but not deeply, the punctures becoming sparser and coarser towards the middle of the former and the antero-internal space of the latter being lævigate. The hind body is punctured very similarly to the metasternum. The hind femora are very much wider than the intermediate, the apex of their inner margin being strongly but not sharply dentate. The lower two teeth on the external margin of the front tibiæ are very strong; the uppermost is sharp and well defined but less than half as large as the second; the edge of the tibia from its base to the apex of the uppermost tooth is almost a right line. The produced apex of the basal piece of the hind claws is stout and just about half as large as the entire apical piece.

N. Territory of S. Australia; taken by Dr. Bovill.

N.B.—Specimens from the same locality in the collections of Sir W. Macleay and the Adelaide University differ only in being of a uniform ferruginous colour.

H. INCOLA, sp.nov.

Sat elongatus; sat convexus; postice leviter dilatatus; sat nitidus; ferrugineus, antennis testaceis; pilis fulvis vestitus; capite crebre, prothorace elytris pygidioque sat sparsim, rugulose leviter punctulatis; labro clypeum late sat fortiter superanti;

antennis 9-articulatis; unguiculis bifidis; coxis posticis metasterno haud brevioribus. [Long. $3\frac{1}{5}$, lat. 2 lines (vix).

The part of the labrum overtopping the clypeus is very wide and the sides of the clypeus are very little prominent so that from the most favourable point of view the "trilobed outline" of the head appears only feebly developed, with the middle lobe nearly as wide as the lateral ones. The clypeal suture is scarcely marked; the sculpture of the head close and coarse but not deep. The prothorax is slightly more than half again as wide as long, its base not quite half again as wide as its front which is moderately concave with angles but little produced; the sides are gently arched; the hind angles from every point of view appear rounded off; the puncturation is sparing (spaced so that about 15 punctures occupy the length of the middle longitudinal line) and by no means fine, but not deep, and has a slightly rugulose appearance. The elytra are squamosely, lightly and rather sparingly punctulate, their transverse wrinkling is conspicuous, their lateral fringe normal, their apical membrane normal. The hind coxæ are of the same length as the metasternum; the ventral series consist of long hairs. The puncturation of the under surface is fairly close and strong on the sides of the metasternum becoming gradually more sparing hindwards, and also becoming more sparing from all the lateral parts towards the middle, but the hind coxæ have not a very well defined impunctate space except at their extreme inner margin. The hind femora are considerably wider than the intermediate, their inner margin being moderately and roundly produced at the apex. The anterior tibiæ resemble those of *H. Darwini*. The produced apex of the basal piece of the hind claws is stout and about half as large as the apical piece.

A single specimen from Petersburg (S.A.)

H. LIVIDUS, sp.nov.

Minus elongatus; postice vix dilatatus; minus nitidus; lividus (nonnullis exemplis piceo-tinctis); pilis brevibus adpressis pallidis

vestitus; capite prothoraceque fortiter, elytris minus fortiter, sat sparsius punctulatis; labro clypeum sat leviter sat late superanti; antennis 9-articulatis; unguiculis breviter bifidis.

[Long. $2\frac{2}{5}$, lat. $1\frac{1}{5}$ lines (vix).

The "trilobed outline" of the head appears fairly well defined, the middle lobe more than half as wide as, and slightly longer than, the lateral lobes. The clypeus does not form a continuous surface with the rest of the head from which it is separated by a very well defined feebly angulated suture; it is widely and gently emarginated in front with a continuous reflexed margin. The puncturation of the head and prothorax is strong and coarse, rather close on the clypeus, less so hindward. The prothorax is not quite twice as wide as long, its base nearly half again as wide as its front which is gently concave, with slightly prominent angles; the sides are very gently arched, the basal angles scarcely defined from any point of view; the base is scarcely bisinuate or lobed. The elytra are punctured much as the prothorax but scarcely so strongly, their transverse wrinkling is scarcely apparent, their lateral fringe normal but not at all strong, their apical membrane fairly defined. The puncturation of the pygidium (which is clothed with long erect hairs) is very sparing but rather coarse. The hind coxæ are considerably shorter than the metasternum and longer than the 2nd ventral segment; these, and the metasternum are rather closely set with very large deep punctures which do not become much more sparing towards the middle; the punctuation of the ventral segments is sparing and not very strong on the sides, but almost entirely obsolete in the middle. The ventral series consist of long fine hairs and are but little conspicuous. The hind femora are much wider than the intermediate and their inner apical angle is scarcely prominent and quite rounded off. The three external teeth of the anterior tibiæ are all well defined and sharp,—the lower two very strong,—the uppermost scarcely half as large as the 2nd. The apical piece of the hind claws is very minute,—much less than a quarter the size of the basal piece

and is stouter, but very little longer than the produced apex of the latter.

This species bears much resemblance to an *Aphodius.*

N. Territory of S. Australia; taken by Dr. Bovill.

H. SUBFUSCUS, Macl.

Sir W. Macleay has forwarded a specimen of this insect to me. To the characters mentioned by him (P.L.S.N.S.W., 1888, p. 916) it will be well to add the following; antennæ 9-jointed, "trilobed outline" of head fairly defined (the middle lobe being more than half as wide as the lateral ones), hind coxæ decidedly shorter than metasternum and decidedly longer than 2nd ventral segment, uppermost tooth on external margin of front tibiæ much less than half as large as the middle tooth, apical piece of hind claws about half as large as the basal piece and quite twice as large as the produced apex of the latter.

H. BOREALIS, sp.nov.

Elongatus; postice vix dilatatus; minus nitidus; ferrugineus; pilis brevibus adpressis pallidis vestitus; sat æqualiter sat crebre minus subtiliter punctulatus; labro clypeum fortiter sat anguste superanti; antennis 9-articulatis; unguiculis bifidis.

[Long. $3\frac{1}{5}$, lat. $1\frac{2}{5}$, lines.

The "trilobed outline" of the head appears distinct, but irregular, —owing to the slight convexity of the lateral lobes as compared with the middle one which appears considerably longer and scarcely more than half as wide as the former. The clypeus almost evenly continues the plane of the rest of the head from which it is separated by a fairly defined scarcely angulated suture; its front is widely and feebly concave with the reflexed margin not carried distinctly across. The prothorax is not much less than twice as wide as long, its base about half again as wide as its front which is bisinuate with slightly produced angles; the sides are very

gently arched, the basal angles much rounded off; the base is gently bisinuate and feebly lobed hindward in the middle. The transverse wrinkling of the elytra is very slight, their lateral fringe normal, their apical membrane narrow but distinct. On the head, front of prothorax, and pygidium are a few long erect hairs. Owing to the want of transverse wrinkles on the elytra the sculpture has a distinctive appearance; perhaps of the commoner species hitherto described *H. testaceus*, Blackb., comes nearest to it in that respect, but has somewhat finer sculpture throughout. The hind coxæ are much shorter than the metasternum and very decidedly longer than the 2nd ventral segment; they and the metasternum are rather sparingly and strongly punctured at the sides,—the former being impunctulate, the latter finely punctulate, internally. The puncturation of the ventral segments is much finer than that of the sides of the metasternum but is continuous all across. The ventral series consist of coarse red hairs but are rather inconspicuous. The hind femora are not much wider than the intermediate, their inner apical angle being fairly defined but scarcely prominent. The three external teeth of the anterior tibiæ are extremely robust and sharp, the uppermost being about half as large as the middle one. The apical piece of the hind claws is scarcely a quarter the size of the basal piece and is scarcely so large as the produced apex of the latter. The basal joint of the hind tarsi is very distinctly shorter than the second.

The real allies of this species appear to be among the group with 8-jointed antennæ,—*H. piger*, *lateritius*, &c., to some of which it bears much resemblance. From *H. subfuscus*, Macl., it differs *inter alia* by its much more strongly and narrowly elevated labrum.

N. Territory of S. Australia; taken by Dr. Bovill.

H. sparsus, sp.nov.

Sat elongatus; postice vix dilatatus; sat nitidus; ferrugineus (exempli typici capite prothoraceque obscurioribus); pilis brevibus

adpressis pallidis vestitus; capite crebre rugulose, prothorace elytrisque sparsim fortius, pygidio obsolete, punctulatis; labro clypeum leviter late superanti; antennis 9-articulatis; unguiculis bifidis. [Long. $3\frac{1}{5}$, lat. $1\frac{3}{5}$ lines (vix).

The "trilobed outline" of the head appears fairly defined,—the middle lobe shorter than, and considerably more than half as wide as, the lateral lobes. The clypeus does not form an even surface with the rest of the head from which it is separated by a well-defined straight suture; its front is rather strongly concave with the reflexed margin very finely continuous in the middle. The prothorax is $\frac{3}{4}$ again as wide as long, its base about half again as wide as its front which is gently concave with very feeble angles; the sides are gently arched, the hind angles quite rounded off; the base is scarcely bisinuate and rather strongly convex hindward all across. The elytra are punctured a little more closely than the prothorax, their transverse wrinkling is very slight, their lateral fringe normal, their apical membrane scarcely distinct. The hind coxæ are decidedly shorter than the metasternum and not much longer than the 2nd ventral segment; the metasternum is rather sparsely and feebly punctured at the sides, more sparsely and strongly towards the middle; the hind coxæ are rather coarsely punctured except a small lævigate intero-anterior portion. The ventral segments are feebly and sparingly punctured at the sides, almost lævigate in the middle. The ventral series are fairly conspicuous, consisting of long stoutish hairs. The hind femora are not much wider than the intermediate, their inner apical angle ill-defined. The three external teeth of the anterior tibiæ are well-defined but not particularly acute, the uppermost being less than half as large as the middle one. The hind claws scarcely differ from those of *H. borealis.* The basal joint of the hind tarsi is distinctly shorter than the 2nd joint.

The puncturation of this species is exceptionally sparse,—on the prothorax as much so as in *H. Augustæ,* Blackb.,—on the elytra scarcely closer than on the prothorax.

N. Territory of S. Australia; taken by Dr. Bovill.

H. ACUTIFRONS, sp.nov.

Minus elongatus; postice dilatatus; minus nitidus; testaceo-ferrugineus, capite prothoraceque nonnihil obscurioribus; elytris pilis brevibus erectis minus crebre vestitis; clypeo crassissime rugulose, capite postice prothoraceque sparsius leviter nec rugulose, elytris sat fortiter subrugulose, pygidio (hoc setis longis vestito) sparsim obscure, punctulatis; labro clypeum late triangulariter sat fortiter superanti; antennis 9-articulatis; unguiculis bifidis.

[Long. $2\frac{4}{5}$, lat. $1\frac{3}{5}$ lines (vix).

The "trilobed outline" of head is very peculiar, the middle lobe (which is longer, and scarcely narrower, than the lateral lobes) being acutely triangular. The clypeus is very distinct from the rest of the head, from which it is separated by a strong angulated suture, its front being widely and rather strongly concave with the reflexed margin obsolete in the middle. The prothorax is twice as wide as long, its base scarcely half again as wide as its front, which is gently concave, with scarcely produced angles; the sides are strongly rounded, the hind angles quite rounded off, the base gently convex all across, evenly continuing the curve of the angles. The elytra are punctured more strongly and very much more closely than the prothorax; their transverse wrinkling is fairly defined, their lateral fringe normal, their apical membrane obsolete. The hind coxæ are decidedly shorter than the metasternum and decidedly longer than the 2nd ventral segment; the puncturation of the metasternum is well defined, and rather strong and close at the sides, but the middle is almost lævigate; the hind coxæ are almost without puncturation. The ventral segments are punctured sparingly and coarsely all across; the ventral series are scarcely conspicuous the whole ventral surface being clothed somewhat densely with fine long hairs. The hind femora are not much wider than the intermediate, their inner apical angle is but slightly defined. The three external teeth of the front tibiæ are fairly strong, the uppermost being about half as large as the middle one. The apical piece of the hind claws is

about $\frac{1}{3}$ the size of the basal piece and nearly twice as large as the produced apex (which is truncate at its end) of the latter. There is a conspicuous fuscous spot on the prothorax near the lateral margin on either side.

This is an extremely distinct species.

Yorke's Peninsula.

N.B.—This species must be near *H. pellucidus*, Burm., but if I am right in thinking that I have both sexes before me, the anterior claws of the male are quite different; also the anterior tibiæ seem to be differently toothed; it seems unlikely that Dr Burmeister could have failed to note the very peculiar angulation of the labrum, or the spots (apparently quite constant) on the prothorax. The description of the puncturation also does not agree very satisfactorily.

H. ROTUNDIFRONS, sp.nov.

Minus elongatus; postice dilatatus; sat nitidus; ferrugineus, antennarum clava testacea; pilis erectis minus crebre vestitus; clypeo crebrius minus crasse, capite postice prothoraceque fortiter sparsim, elytris squamose fortiter minus sparsim, pygidio sparsim subtilius, punctulatis; labro clypeum late vix perspicue superanti; antennis 9-articulatis; unguiculis bifidis. [Long. $4\frac{2}{5}$, lat. $2\frac{1}{5}$ lines.

The labrum rises so slightly above the clypeus and the sides of the latter are so feebly reflexed that (from the point of view most favourable for observing a "trilobed outline" of the head) the front outline appears an almost even curve, the convexity of which however is a little greater in the middle than it would be if the curve were quite even. The clypeus does not form an even surface with the rest of the head,—from which it is separated by an almost straight suture; its front is scarcely concave, but is without a reflexed margin. The prothorax is about $\frac{2}{5}$ again as wide as it is long; its base about half again as wide as its front, which is feebly concave with angles but little produced; it is widest a little behind the middle its sides being rather strongly arched, its basal

angles well marked but obtuse, its base (from a certain point of view) distinctly bisinuate and moderately lobed hindward. The elytra have little or no indication of striation,—at most some semblance of a sutural stria,—their transverse wrinkling is fairly defined from some points of view, their lateral fringe normal, their apical membrane obsolete. The hind coxæ are decidedly shorter than the metasternum and decidedly longer than the 2nd ventral segment; the puncturation of both these is at the sides strong but not close, being on the latter very sparing towards the middle, and the former having a small lævigate antero-internal space. The ventral segments are punctured at the sides rather finely and closely, in the middle more coarsely and sparsely, the punctures there tending to a linear transverse arrangement. The ventral series consist of fine long hairs and are not very conspicuous. The hind femora are evidently wider than the intermediate, their inner apical angle much rounded and but little prominent. The three external teeth of the anterior tibiæ are thick and blunt, the uppermost about half as large as the 2nd. The apical piece of the hind claws is nearly half as large as the basal piece and not much larger than the produced apex of the latter.

Taken by Mr. T. G. Sloane at Albury, N.S.W.

NOTES ON AUSTRALIAN COLEOPTERA, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem. Linn. Soc. N.S.W.

Part III.

The following notes and descriptions embody the results of the study of various Coleoptera chiefly belonging to my own collection.

CARABIDÆ.

Eutoma (Carenum) sumptuosum, Westw.

I have received from Dr. Bovill a very remarkable insect taken in the N. Territory which appears to be probably identical with the type on which Prof. Westwood's brief description of this insect was founded. It agrees very exactly in size and proportions (long. 10, lat. 3 lines) and with such scanty record of the sculptural characters as the Professor gives, viz.,—"two punctures on the elytra near the base and two others subapical" (these four punctures are very large and strong),—also, "front tibiæ externally bidentate" (the teeth are very long and acute, and the smaller teeth above them are so placed as to be quite invisible when the tibia is looked straight down upon). These characters would be quite insufficient, of course, for identification among the great number of Australian *Scaritidæ* now known,—but the colouring mentioned in the description is so peculiar that I think it justifies my identification. Professor Westwood describes it thus,—"nigrum, igneo colore varium." In the example before me the head is black with the exception of the portion behind the eyes (all across) and part of the space between the eyes and the frontal sulci, which are bright green. The prothorax all round the

margins except in front is of a fiery copper colour changing internally to bright green, while the disc is occupied by a large black triangle, the front being its base and its apex falling behind the middle. The colour of the elytra is across the base (widely) brilliant golden which changes gradually backward to green; a large common purplish-black patch occupies the middle part,—its front considerably before, its apex a little behind, the centre of the suture; in some lights a smaller common subapical patch of similar colour is apparent.

The insect is evidently a *Eutoma*. The head across the eyes is scarcely narrower than the prothorax which is of the same width as the elytra (by measurement; it looks decidedly wider at a casual glance). The frontal sulci are very strong, diverge strongly hindward to the level of the back of the eyes, and are connected behind by a very strong transverse impression; there are two supra-orbital punctures. The prothorax is slightly transverse (as 7 to 6), its front truncate, its base slightly concave; the lateral margins bear three strong setiferous punctures on either side. The basal cluster on each elytron consists of five strong punctures; the anterior discal puncture is about a fifth the length of the elytron distant from the base.

DYTISCIDÆ.

Canthydrus bovillæ, sp.nov.

Ovalis; convexus; posterius attenuatus; nitidus; niger, capite anterius prothoraceque ad angulos anticos rufo-testaceis; elytris gutta transversa pone medium testacea, punctis sparsis sat conspicuis; antennis testaceis; pedibus rufis, posterioribus magis obscuris. [Long. $1\frac{2}{5}$, lat. $\frac{4}{5}$ line.

This species must be very near *C. guttula*, Aubé (from Madagascar and Mauritius), but differs apparently in having the red mark on each elytron in the form of a somewhat irregular transverse line, rather than of a round spot.

Northern Territory of S. Australia; taken by Mrs. Bovill and dedicated to that lady.

HYDROPHILIDÆ.

PHILHYDRUS BURRUNDIENSIS, sp.nov.

Late ovalis; minus nitidus; crebre subfortiter punctulatus; subtus pubescens; niger vel piceo-niger; antennis, palpis, prothoracis et elytrorum lateribus, tarsisque, plus minus rufescentibus; elytris stria suturali perspicua haud instructis.

[Long. 4, lat. 2 lines (vix).

This species bears much resemblance to a very large darkly coloured example of *P. melanocephalus*, Fab., from which species indeed it scarcely differs in respect of sculpture except in having no sutural stria on the elytra; nor do I observe any difference in the form or proportion of the various segments and members except that the maxillary palpi are very much longer, equalling in length the head and prothorax together. The apical joint of the palpi is perfectly concolorous with the other joints. The insect, as a whole, is wider than *P. melanocephalus* in proportion to its length.

Burrundie, N. Territory of S. Australia; taken by Dr. Bovill.

BEROSUS AURICEPS, sp.nov.

Oblongo-ovatus; convexus; supra testaceus; capite (postice longitudinaliter carinato) aureo vel aureo-æneo, prothorace maculis dorsalibus 2 elongatis fere connexis et elytrorum striis (iis marginem lateralem versus exceptis) maculisque vix perspicuis nonnullis, nigricantibus; subtus fuscus (capite nigro excepto); palpis, antennis, pedibusque, pallide fusco-testaceis; capite crebre subrugulose, prothorace sparsius sat leviter (linea longitudinali media lævigata excepta), punctulatis; elytris apice acuminatis, sat fortiter striatis; striis subtilius punctulatis; interstitiis planis, eodem modo quo striæ punctulatis. [Long. 2, lat. $\frac{4}{5}$ lines.

The specimen (female) on which the above description is founded is conspicuous by its pale elytra being streaked with fine black striæ (the external three striæ, however, being black only on a

short space about the middle of their length) and punctured with blackish punctures, and being otherwise almost without markings, —although when carefully looked at some indication of a fuscous spot can be seen on each of them near the suture before and close behind its middle and near the middle of the external margin; it is also characterised by having the thinly dispersed punctures on the interstices between the striæ of about the same size as those in the striæ. The 5th ventral segment is excised as though a segment of a circle greater than a semicircle had been cut out, so that the apices of the margin of the excision point partly towards each other and not directly hindward; the margin of the excision is however flattened (or even a little convex) in front,—this being especially conspicuous if the segment be viewed obliquely from behind,—from which point of view the excision looks almost square. There is a fairly large 6th segment visible which is terminated by two filaments.

The closely punctured head separates this species from all I have previously described of the genus, except *duplopunctatus*, *discolor* and *Flindersi;* the combination of a sparsely punctured prothorax and wholly testaceous palpi will distinguish it from all the latter. From some of M. Fairemaire's species (as also from *B. Australiæ*, Muls.) its elytra not bispinose at the apex are a sufficient distinction. From the rest (except *sticticus* which has the head almost impunctulate in front) it differs in having the apex of the elytra pointed,—not obtuse. If this latter distinction be (as I think it is) founded on a variable character,—it also differs from the three species concerned as follows,—from *B. ovipennis* in being more elongate, with the prothorax not "densely punctured," and from *B. approximans* and *stigmaticollis* in its more sparsely punctured prothorax and apparently in the greater comparative width of the same; M. Fairemaire distinguishes both those species from the European *B. affinis* by their prothorax being "notably narrower than the elytra," whereas in the present species there is less difference than in *B. affinis* between the width of the prothorax and of the elytra. I observe that the eyes are a little more strongly granulated than in *B. affinis*.

N. Territory of S. Australia; taken by Dr. Bovill.

N.B.—A specimen (also female and with identical sexual characters) from the same locality is smaller (long. $1\frac{3}{5}$ lines) and differs in characters which would certainly seem specific,—but I think the identity of sexual characters so important that without knowing the males I shall regard it as a variety. It has scarcely any trace of markings on the prothorax and has that segment and the elytra decidedly more coarsely, and indeed quite differently, sculptured,—the former having evidently closer (though by no means close) puncturation, and the latter being less pointed at the apex, with the striæ quite coarsely punctulate and the interstices not quite flat and scarcely punctured at all.

LAGRIIDÆ.

Lagria tincta, sp.nov.

Oblonga, postice minus dilatata; supra crebre crasse sat æqualiter punctulata; pilis longis sparsius vestita; rufa, piceo-umbrata. [Long. $3\frac{3}{5}$, lat. $1\frac{2}{5}$ lines.

The under surface is red, with the sides of the metasternum and some blotchy marks on the ventral segments (chiefly down the middle) piceous. On the upper surface the sides of the prothorax and the inner half of each elytron are obscurely piceous, the piceous portion of the latter interrupted about its middle by an ill-defined round spot of a brighter red colour than any other part of the elytra. The antennæ are not much longer than the head and prothorax together and are very stout, the joints (except the last) red with their apex black: the 3rd joint is distinctly but not much longer than wide, the 4th scarcely so; joints 5-10 as wide as long, joint 11 about equal to the preceding three together. The femora (except at their extreme base) are nearly black. The long erect hairs (with which the upper surface is rather densely clothed) are partly pallid and partly dark, rather confusedly mingled together. The punctures on the underside are lightly impressed and neither close nor large. The prothorax is nearly

as long as wide and has gently arched sides, its greatest width being just in front of the middle.

Compared with *L. grandis*, Gyll., this species is considerably smaller and very much less dilated behind; its antennæ are much shorter and stouter; its prothorax and head are a little more coarsely and rugulosely punctured, and the same coarse rugulose sculpture extends over its elytra; the apical joint of the palpi is less strongly securiform; the tarsi are more slender, with the penultimate joint not so much wider than the preceding joints, the ventral segments are much more strongly punctulate, and the eyes are more prominent and more strongly granulated.

A specimen in the South Australian Museum which I believe to be *L. cyanea*, Macl., has a shorter prothorax and less rugulose puncturation, besides being very differently coloured. From the brief description of *L. affinis*, Boisd., that species would appear to have the prothorax and elytra dissimilarly punctured, and the expression "geniculis nigris" would seem to differentiate it from the present insect. The three species described by Sir W. Macleay from Cairns all differ widely in colour and other characters. *L. tomentosa* Fab., also is very different.

N. Territory; taken by Dr. Bovill.

LONGICORNES.

TRYPHOCHARIA.

I have to acknowledge and correct an unfortunate error in my notes on this genus published in the Proceedings (2), Vol. III. part 4, pp. 1456-63. At the time I was unable to refer readily to the description of *T. hamata*, Newm., and accepted without verification the assertion in Mr. Masters' "Catalogue of Australian Coleoptera" that that species and *T. longipennis*, Hope, are identical. I have since had reason to conclude that this is not the case—indeed, judging by Hope's description, his insect is as unlike *hamata* as could well be. The result of this oversight

on my part was that I described as being probably *hamata* an insect which can only be said to be *probably longipennis*, and, still worse, described the true *hamata* as new under the name *uncinata.* If those who possess last year's Vol. of the Proceedings will run their pen through the heading " T. HAMATA " on page 1458, and substitute that name for "T. UNCINATA, sp.nov." on p. 1461 the mistake will be corrected.

URACANTHUS ACUTUS, sp.nov.

Obscure ferrugineus, nonnullis exemplis antennis basi pedibusque plus minus infuscatis; parum nitidus; dense breviter (elytrorum parte antica subglabra excepta) pubescens; prothorace vix evidenter transversim strigato, crebre subtilius subrugulose punctulato; elytris apice spinuloso-productis, obscure costatis; antice crebrius subtilius punctulatis, punctis postice gradatim etiam crebrioribus subtilioribus; parte apicali coriacea. [Long. $7\frac{3}{5}$, lat. $1\frac{3}{5}$ lines.

Very distinct from all others yet described of the genus. The elytra,—each drawn out to a point,—the peculiar sculpture of the same, and the very feeble transverse strigosity of the prothorax are strongly characteristic.

From Mr. T. G. Sloane; Victoria.

RHINOPHTHALMUS MODESTUS, sp.nov.

Elongatus; gracillimus; sat parallelus; obscure fuscus, elytris paullo pallidioribus; dense breviter sat pallide pubescens; rostro quam *R. nasuti* breviori magis parallelo; prothorace haud transversim strigoso. [Long. 6, lat. $\frac{4}{5}$ line (vix).

Very much smaller than *R. nasutus*, Newm., and with the rostrum evidently shorter, and very parallel. From *R. marginipennis*, Fairm., it would seem to differ by the absence of elytral vittæ; from M. *striicollis*, Fairm., by the prothorax not transversely strigose; and from all three by the extremely parallel form. The anterior margin of the eye is distinctly nearer to the apex of the

snout than to the front of the prothorax. The eyes are very similar to those of *R. nasutus*,—they are almost contiguous in the male on the upper surface (more nearly than on the underside) while in the female they are almost equally approximate both above and below. In the male the fifth ventral segment is densely clothed with long pilosity at and about the apex, while the apical segment in the female is evenly pubescent and simply fringed behind with longer hairs.

Melbourne; taken by Mr. T. G. Sloane.

MACRONES DEBILIS, sp.nov.

Angustissimus; ferrugineus, elytris plus minus pallidioribus, abdomine plus minus infuscato, tarsis posticis haud pallidioribus; prothorace brevi, lateribus rotundatim nec fortiter gibbosis; elytris costatis. [Long. 6, lat. $\frac{4}{5}$ line.

In some specimens the head, prothorax, legs, and even antennæ from certain points of view appear purplish-red,—especially the dilated part of the femora and of the basal joint of the antennæ. Of previously described species this seems to be nearest to *M. acicularis*, Pasc., from which it differs by its unicolorous red head, the absence of whitish-yellow colouring from its antennæ and hind tarsi, and the comparatively greater width and less length of its prothorax. *M. capito* and *exilis*, *inter alia*, are much larger and have the prothorax much more strongly bulging out on either side in front of the posterior constriction. *M. rufus* (which I have not seen) is described as being more than twice as large with the thorax spined on either side. *M. subclavatus*, *inter alia*, has blue-black elytra. In the present species the disc of each elytron bears two longitudinal costæ between the costate suture and margin.

Victoria.

ORODERES UNIFORMIS, sp.nov.

Elongatus; fortiter rugulose punctulatus; cyaneus; antennis apicem versus, elytris (basi excepta), femoribus basi, tibiis tarsisque,

obscure æneo-ferrugineis; prothorace quam latiori sat longiori.
[Long. $5\frac{1}{2}$, lat. $\frac{4}{5}$ line (vix).

As in *O. humeralis*, Saund., the head, the prothorax, the basal five or six joints of the antennæ, and the legs, are clothed with long hairs. The front part of the elytra also is hairy. The extreme apex of the antennæ is obscurely yellow. Rather more than the basal $\frac{1}{3}$ of the elytra is bright blue, whence this colour gradually fades into dull ferruginous with a slight metallic tone.

Western Australia; taken by E. Meyrick, Esq.

Amphirhoe sloanei, sp.nov.

Picea; capite, antennarum basi, prothorace antice, elytris basin versus, pedibusque (femorum clava excepta), rufis; abdomine nonnullis exemplis rufescenti; elytris intus subtilius, extus fortius, crebre rugulose punctulatis; his apice biapiculatis vittis 2, interna elongata, externa perbrevi, flavo-eburatis; prothorace quam latiori longiori; tarsorum anticorum articulo basali elongato subparallelo.
[Long. 6-7, lat. $1\frac{1}{5}$-$1\frac{2}{5}$ lines.

This species appears to be mixed in collections with *A. decora*, Newm., to which it bears much resemblance, and from which it differs as follows:—it is a more slender insect, with the ferruginous parts much brighter,—the head especially (which in *decora* is piceous behind) being unicolorous and of quite an orange ferruginous tone; the prothorax is more elongate and less swollen on the sides (in *decora* by measurement it is scarcely longer than its greatest width, in this species decidedly so); the inner extremity of the apical truncation of the elytra is obsoletely, the outer distinctly, spinose; the basal joint of the anterior tarsi in both sexes is much longer than wide and is almost parallel-sided, whereas the same joint in *decora* is of a triangular shape and is scarcely longer than its width across the apex.

My specimens of *decora* were taken near Port Lincoln,—and they are evidently identical with the species figured by Lacordaire

as *A. decora*, The original type is from Tasmania. My examples of *A. Sloanei* were taken by Mr. T. G. Sloane in Gippsland, Victoria.

PHALOTA OBSCURA, sp.nov.

Fusco-brunnea, elytris (nonnullis exemplis basin versus solum), antennis, tibiis, tarsisque, paullo dilutioribus; pilis longis erectis sparsius vestita; prothorace transversim rugato; elytris crebre sat fortiter subrugulose punctulatis. [Long. 3, lat. $\frac{3}{5}$ line (vix).

The prothorax is almost twice as long as its greatest breadth. The elytra are rounded behind, and scarcely flattened dorsally. This species is coloured very differently from the two previously described. I have seen a good many specimens which scarcely vary except in the elytra having their whole surface or only the basal part of a paler hue than the head and prothorax. It differs from its congeners also, it would seem, in having a wide channel (much abbreviated at both ends) down the prothorax and also in having the prothorax very distinctly transversely wrinkled; mixed up with, and much obscured by, this transverse wrinkling there is close rather fine and rugulose puncturation.

Port Lincoln; also sent to me from Victoria by Mr. T. G. Sloane.

LYCHROSIS.

Having lately acquired specimens appertaining to this genus from several parts of Northern Australia I have been compelled to regard the examples from the N. Territory of S. Australia (mentioned in the "Proceedings" for 1888, p. 1469) as distinct from *P. luctuosus*, Pasc., to which I attributed them. The pattern on the elytra in all the species I have seen varies to such an extent that I fear little reliance can be placed on it for distinguishing species. The specimens from the N. Territory, however, have much longer antennæ than *L. luctuosus* (they slightly exceed the length of the body in both sexes). Whether they are *L. afflictus*, Pasc., I cannot make up my mind, as the description

of that insect does not mention the length of the antennæ; if they are identical with it the description must have been founded on a much darker example than any I have seen, but in some respects (*e.g.*, the greater size and the colouring of the antennæ) they seem to correspond very well. The specimen coming nearest to actual identity with Mr. Pascoe's fig. of *L. luctuosus* was sent to me from Northern Queensland by Mr. T. G. Sloane, but it was accompanied by another so extremely different in markings that I cannot satisfy myself absolutely of the two not being specifically distinct. I think the genus requires to be studied by some one resident in tropical Australia, who could be certain which specimens were taken actually in company.

Illæna, Er.

There appears to be little doubt that *Neissa*, Pasc., is identical with this genus. Mr. Pascoe distinguishes his genus on the ground of its having the prothorax "abruptly spined" at the sides, whereas Erichson calls that of *Illæna* only "slightly nodose at the sides." Erichson, however, though using this expression in characterising the *genus*, yet in describing the *species* varies it somewhat, saying that the sides of the prothorax are "furnished with a small tubercle," which certainly brings the character of *Neissa* too near it to justify generic distinction. Mr. Pascoe's S. Australian species are very likely to be distinct from Erichson's Tasmanian *I. exilis*, although no very good distinctive character is mentioned for the smaller one. I possess examples (from Port Lincoln) of an insect that is probably identical with *Illæna* (*Neissa*) *inconspicua*, Pasc.; and also a single example (from Western Australia) of the following apparently new species.

Illæna meyricki, sp.nov.

Sat angusta; fusco-picea, ore, antennis, pedibus, elytrisque, dilutioribus; his piceo-notatis; corpore supra obscure sat crasse

nec crebre (capite prothoraceque nihilominus paullo crebrius) punctulatis; antennarum articulo tertio primo manifeste longiori. [Long. $1\frac{4}{5}$, lat. $\frac{3}{5}$ lines.

Compared with the S. Australian insect which I take to be *I. (Neissa) inconspicua*, Pasc., this species is evidently of a narrower and more parallel form, and has the 3rd and 4th antennal joints longer in comparison with the scape. The example before me is somewhat abraded, but I should judge that a fresh specimen would be marked and coloured very similarly to Mr. Pascoe's insect. Unfortunately in the description of *I. exilis*, Er., the 3rd joint of the antennæ is not compared in length with the scape, but Erichson's species is said to be "black," with certain parts "reddish pitchy;" and as the insect I am describing has no black coloration whatever, and the two are found in very widely separated localities, it is not at all likely that they are identical. In all the specimens I have seen of this genus the surface of the prothorax is a little uneven; in *I. inconspicua* the unevenness is very ill-defined, but seems to consist of one or more obscure transverse wheals and a slightly more apparent longitudinal carina which is best defined in front; in the present insect the unevenness of the prothoracic surface is not quite so ill-defined, and when carefully examined is found to consist of two rather obscure round swellings placed one on either side of the middle line not far behind the front, and of a longitudinal keel which is scarcely evident except in its *hinder* half.

A perfectly fresh specimen of the species that I regard as *I. inconspicua* has the elytra marked as follows:—The darker portion being regarded as the ground colour a dull silvery stripe commences below each shoulder (where it is narrow) and runs (increasing in width all the way) in a slight curve to the suture,—which its front edge meets at a distance from the base of a quarter, and its hind edge of two-thirds, the length of the suture. From the hinder point where this stripe touches the suture another stripe similarly coloured (narrow at the suture and widening externally) runs across obliquely to a point a little before the apex of the lateral

margin; the space occupied by these stripes is slightly depressed. The basal crest is placed longitudinally on each elytron. The lighter part of the elytra being regarded as the ground colour, there appear,—a common somewhat quadrate, dark basal spot,—a subtriangular dark spot on each elytron having its base on the lateral margin and its apex (which is truncated and forms an obscure longitudinal carina) near the suture,—and a common, subtriangular, apical, dark spot. These markings are more obscure as specimens are less fresh, but in all I have seen of the genus I can discern traces of them. In the specimen on which I found *I. Meyricki* they are *extremely* obscure.

Western Australia; collected by E. Meyrick, Esq.

PHYTOPHAGA.

DIAPHANOPS.

Dr. Chapuis in Vol. X. of the "Genera des Coléoptères" mentions the existence in collections of several forms closely allied to *D Westermanni*, Boh., some of which he thinks may be distinct species. I have recently examined the specimens appertaining to this genus in my own collection and in that of the South Australian Museum, all from Western Australia, and find among them three forms that certainly appear to be specifically distinct *inter se*. I am doubtful whether any one of them is *D. Westermanni*, but one is sufficiently near to be disqualified from being regarded as certainly distinct. The points in which it differs from the description of *Rhynchostomis curculionides*, Lac., (which Dr. Chapuis asserts to be identical with *D. Westermanni*) are as follows,—the prothorax is less elongate and more coarsely punctured than the description would lead one to expect. The length of the prothorax is said to be $\frac{2}{3}$ greater than the width. I cannot help thinking that this statement is founded on a mistaken observation, for although the prothorax on casual view appears very elongate I find that careful measurement shows the widest part of the prothorax in all the examples I have seen of the genus to measure at most very slightly less than the

length. The surface of the prothorax is said to be "covered with fine rugosities hardly distinct under a lens"; although this appears to be the case in a fresh specimen owing to the presence of pubescence I find that the removal of the pubescence exposes a surface very distinctly, although finely, rugulose-punctulate.

DIAPHANOPS MEYRICKI, sp.nov.

Oblongus, postice angustatus; rufo-brunneus, pilis densis (supra pallide brunneis, subtus albidis) tectus; palpis nigris; prothorace quam basi latiori quinta parte longiori; elytris utrinque oblique impressis; antennis corporis dimidio sat brevioribus.

[Long. $5\frac{3}{5}$, lat. 2 lines.

The entire insect (except the palpi) is of a uniform pale reddish brown colour densely clothed with silky pubescence on every part except the antennæ, which however are quite concolorous with the general surface. The pubescence is of the ground colour on the upper surface except the scutellum, which together with the underside is silvery white. The whole upper and under surface is finely and very closely punctulate, but the sculpture is entirely hidden beneath the pubescence. The sides of the prothorax are gently concave from the base to beyond the middle where the segment is nearly as wide as at the base and whence they converge slightly to the apex; a longitudinal median carina is feebly indicated on the hinder half of the dorsal surface. The elytra across the base are twice as wide as the base of the prothorax and are evenly and rather strongly narrowed to their apex; the oblique impression on either side is quite distinct but not sharply limited, commencing near the lateral margin a little behind the shoulder and terminating about the middle of the disc half-way to the apex; the elytra are obliquely truncate behind. The antennæ are of the length of the prothorax and head (including the rostrum) together. *Inter alia* the shorter antennæ, of a unicolorous bright pale brown, appear to distinguish the species from *D. Westermanni.*

Three specimens, quite identical *inter se*, were sent to me from Western Australia by E. Meyrick, Esq.

DIAPHANOPS PARALLELUS, sp.nov.

Oblongus, sat parallelus; brunneo-niger, pilis densis (supra griseo-brunneis subtus albidis) tectus; palpis nigris; antennarum articulis basi, tibiisque, rufis; prothorace quam basi latiori vix longiori; elytris lateraliter haud oblique impressis; antennis corporis dimidio sat brevioribus. [Long. 4, lat. $1\frac{2}{5}$ lines.

The pubescence does not differ much in colour from that of *D. Meyricki*,—but that of the upper surface (in the example before me) wants the bright, silky tinge that is displayed on the latter species. The prothorax is of similar form, but is scarcely longer than its width at the base, where moreover the width is scarcely greater than at the dilatation near the front. The elytra differ from those of *D. Meyricki* in being almost parallel nearly to the apex, in their greater convexity, their more rounded apices and in their more even surface. The antennæ are equal in length to $\frac{2}{5}$ the length of the whole body. It should be noted that the tibiæ are somewhat infuscate near their apex.

The parallel form, smaller size, and differently coloured antennæ will distinguish this species from *D. Meyricki*. From the older species the shortness of the antennæ will distinguish it,—as in that insect M. Lacordaire says that they are half as long as the whole body, which I find to be their length in the specimens that I attribute to it; I should judge from the description too that *D. Westermanni* is a less convex insect than this and has a more elongate prothorax. If I am right in my determination of *D. Westermanni* it differs from the present species also in being much less parallel.

A single specimen was taken in Western Australia by E. Meyrick, Esq.

LEMA BIFASCIATA, Fab.

I have received from Dr. Bovill a single specimen (taken in the Northern Territory) which agrees very well with Olivier's brief

description of this insect except in having the hinder part of the under surface of a dark piceous colour. Notwithstanding this colour discrepancy I think it is probably conspecific with the insect described by Fabricius,—the exact habitat of which has not, so far as I know, been previously recorded.

CRIOCERIS RECENS, sp.nov.

Oblongo-parallela; piceo-nigra; elytris basi sat late, ad latera antice anguste, rufescentibus; capite inæquali fortius crebrius punctulato, antice sat producto, sparsim argenteo-pubescenti; antennis crassis, articulo 5° ceteris longiore; prothorace trans medium sparsius minus subtiliter punctulato, antice posticeque lævigato, pone medium transversim impresso, quam longiori paullo latiori, basi quam antice latiori, ad latera coarctato; scutello angusto elongato; elytris postice vix dilatatis, vix striatis, antice sparsim sat crasse seriatim punctulatis, punctis post medium vix distinctis; corpore subtus medio obscure rufescenti, sparsim argenteo-pubescenti. [Long. 4½, lat. 2 lines.

Allied to *C. fuscomaculata*, Clk., but larger and entirely different in colour and markings, &c., &c. The uniform dark pitchy colour of the antennæ and legs (only the extreme base of the former and the tarsi of the latter being obscurely reddish in the example before me) will suffice to distinguish this species from all its Australian congeners.

N. Territory of S. Australia (Dr. Bovill).

TERILLUS.

The following species is very different in facies and in several of its characters from typical members of this genus and I feel much hesitation in associating it with them. It would appear however to bear a good deal of resemblance to *T. perplexus*, Baly, —so that I think I shall not be far wrong in connecting it with that insect. Dr. Chapuis' tabulation of *Eumolpidæ* (Gen. Col. X.) would refer it to *Terillus.*

TERILLUS SUTURALIS, sp.nov.

Sat elongatus; subparallelus; ferrugineus, mandibulis apice, scutellum, suturaque, piceis vel nigris; pilis sat longis pallidis gracilibus (supra nonnullis robustis squamiformibus intermixtis,—his sublineatim dispositis) sat crebre vestitus; supra sat æqualiter crassius subrugulose, subtus multo subtilius, punctulatus; prothorace quam longiori fere duplo latiori, antice minus angustato, lateribus rotundatis. Maris tarsorum anteriorum 4 articulo 1° sat fortiter dilatato, segmento ventrali 5° postice late arcuatim emarginato.

Western Australia; taken by E. Meyrick, Esq.

CUDNELLIA, gen.nov.

Corpus ovale, supra glabrum, subtus pilis erectis minus conspicuis vestitum. Caput verticale usque ad oculos thoraci insertum. Oculi fortiter granulati, subrotundati, sat prominentes. Antennæ corporis dimidio paullo longiores, apicem versus minus incrassatæ. Prothorax ad latera valde declivis, antice fortiter productus, lateribus integris. Scutellum parvum, transversum. Elytra ovalia, coagmentata, abdomen arcte amplectentia. Prosternum inter coxas minus latum, postice truncatum minus dilatatum, episternis antice haud convexis. Femora inermia, medio dilatata. Tibiæ validæ, simplices, apice externo dente dilatato. Tarsi robusti, articulo 3° profunde bilobo, posticorum articulo primo sequentibus 2 conjunctis paullo breviori. Unguiculi appendiculati, divaricati. Metasternum prosterni dimidio vix longius.

I am in considerable doubt as to the affinity of this insect. It bears much resemblance to the species which Dr. Chapuis groups together under the name "*Clidonotites*,"—indeed I found it in company with a *Strumatophyma*. But these are *Chrysomelides*, and the present insect having the 3rd joint of its tarsi deeply and narrowly bilobed should stand through that character among the

Eumolpides, with which tribe it agrees also in the form of the anterior coxæ and prosternal episterna. I am, however, unable to assign it with confidence to any of Dr. Chapuis' groups of *Eumolpides*. By the tabulation of these groups in the Gen. Col. X. p. 229, it would be assigned to the *Iphimeites*, but it does not seem to resemble any of those genera satisfactorily. Its elytra soldered together, and closely embracing the hind body (so that a considerable portion of their lateral part is visible only from beneath), its very short metasternum, and prosternal *episterna* not or scarcely convex in front, are sufficient, taken together, to distinguish it from all its allies. Its habits appear to resemble those of *Pachnephorus* and *Colaspidea*, but I cannot find sufficient reason to treat it as really allied to those genera. The name of the genus is derived from the native Australian name of the district in which I found the insect.

Port Lincoln; under stones.

CUDNELLIA MYSTICA, sp.nov.

Ænea; labro, palporum antennarumque basi, capite subtus, pedisbusque (his plus minus infuscatis), rufo-testaceis; capite crebre fortiter, prothorace duplo (subtiliter et minus subtiliter), scutello vix perspicue, elytris profunde crasse sublineatim minus crebre, punctulatis; his postice substriatis, interstitiis subcostatis; corpore subtus crebre fortiter punctulato.

[Long. $1\frac{2}{5}$, lat. 1 line (vix).

The basal joint of the antennæ is moderately large and stout; it together with the 2nd joint (which is about half its size) is testaceous; joints 3-6 are of a pitchy colour, somewhat slender, not differing much *inter se* in length (joint 5 however slightly longest) and about as long as joint 2; the remaining joints are nearly black, 7-10 a little longer than 5 and somewhat dilated being of an elongate triangular form, 11 of similar size but oval in shape. The claws are thick and swollen in appearance with the basal piece angulate beneath. The sides of the prothorax are very strongly

rounded, its puncturation sparse on the disc but becoming close and coarser towards the sides. The antennæ are thinly clothed with long fine hairs.

Port Lincoln ; under stones.

N.B.—Some smaller specimens (long. $1\frac{1}{5}$ lines, vix), with puncturation slightly coarser throughout, and antennæ and palpi scarcely infuscate towards the apex are probably to be regarded as a mere variation,—or possibly pertain to the other sex.

Rhinobolus, gen.nov.

Corpus oblongum ; supra glabrum ; subtus pilis adpressis parce vestitum. Caput verticale, usque ad oculos thoraci insertum, antice sat cylindricum subrostriforme. Oculi sat magni, rotundati, sat convexi, minus fortiter granulati. Antennæ corporis dimidio paullo longiores, medio graciles, apicem versus minus incrassatæ. Prothorax sat convexus, antice medio fortiter prominens, lateribus integris. Scutellum transversum, sat parvum. Prosternum inter coxas sat latum, postice truncatum dilatatum, episternis antice haud convexis. Femora inermia, medio minus dilatata. Tibiæ simplices, modice robustæ, apice externo minus dentato. Tarsi sat robusti (posticis manifeste longioribus gracilioribus), articulo 3° profunde bilobo, posticorum articulo primo secundo vix longiori. Unguiculi appendiculati, divaricati. Labrum magnum. Mandibula porrecta.

This appears to be an extremely anomalous genus and I am quite unable to specify any other as being its near ally. I do not, however, observe any character suggesting a doubt of its belonging to the *Eumolpidæ* (of which it has quite the facies) except that its antennæ are not quite so widely separated at the base as is usual in the family. But I believe this to be merely an accidental discrepancy connected with the very peculiar form of the head. This organ is produced into a short wide thick beak, with parallel sides, extending forward beyond the base of the antennæ slightly

further than the length of the basal joint of the antennæ. This clypeus is not separated by any conspicuous suture from the rest of the head. The labrum is scarcely shorter than the clypeus. From the antennæ forward the head is somewhat declivous,—so that (the entire head being placed vertically) the front outline of the same as viewed from the side seems to bend back slightly towards the prosternum, somewhat after the manner of *Rhinaria* in the *Curculionidæ*. The mode of insertion of the antennæ is a little suggestive of *Haltica*, but the hind femora are not at all stouter than the intermediate ones, nor are channelled beneath for the reception of their tibiæ. There is an evident interval between the front of the eye and the level of the insertion of the antennæ which moreover is distinctly nearer to the middle longitudinal line of the head than is the inner margin of the eye, but this is accompanied by a narrowing of the head itself.

In Dr. Chapuis' tabulation of groups of *Eumolpidæ* this genus would fall in the *Iphimeites*, and I think it is perhaps more allied to *Terillus* than to any other previously described genus.

RHINOBOLUS NITIDUS, sp.nov.

Nitidus; niger; capite viridi-micante, prothorace elytrisque anguste viridi-marginatis; labro, mandibulis, antennis (his articulo ultimo apice nigro), pedibusque, testaceis; capite lævigato (spatio inter oculos crebrius fortius punctulato excepto); prothoracis disco sparsim subtilius lateribus fortius paullo crebrius, elytris profunde sparsius sublineatim, punctulatis. [Long. $1\frac{1}{5}$, lat. $\frac{3}{5}$ lines.

Of the antennæ joint 1 is moderately long and stout,—2 half as long and equally stout,—3-6 slender and moderately long (5 the longest of them),—7-11 feebly incrassated (7 and 11 the longest of them, each about as long as the basal joint). The prothorax is strongly transverse with very strongly rounded sides; it is but little narrower in front than at the base. The aws are moderately stout, their basal piece feebly dentate.

Yorke's Peninsula; on foliage of Eucalyptus

AGETINUS ÆQUALIS, Blackb.

A small series of this insect recently sent from the Northern Territory by Dr. Bovill displays a considerable variety in colour and size,—some specimens being much smaller (long. $1\frac{2}{5}$ lines) than the type, and there being green and blue as well as copper coloured specimens among them. I do not think however that they represent more than one species.

TOMYRIS RASA, sp.nov.

Oblonga, nitida; supra igneo-cuprea, clypeo antice læte viridi marginato; subtus æneo-viridis, prosterno et abdomine postice cupreo-micantibus; ore, palpis, antennis (articulo ultimo apice nigro excepto), pedibusque, flavis; corpore supra sat æqualiter confertissime subtiliter subaspere punctulato, brevissime confertim aureo-pubescenti; sternis subcrasse, abdomine subtiliter, crebre punctulatis, sat crebre albido-pubescentibus; oculis fortiter convexis; elytris postice sat abrupte declivibus. [Long. $2\frac{1}{5}$, lat. $1\frac{2}{5}$ lines.

The antennæ are about $\frac{3}{4}$ the whole length of the body. The clypeus is bidentate in front. The surface of the head is very gently convex. The prothorax is not much less than twice as wide as long; its front margin is not much narrower than its base and the sides are rather evenly but not very strongly rounded; viewed from above, however, the front appears much narrower than the base, and the sides appear very strongly rounded, with their greatest divergence very near the base. The elytra are not more than $\frac{1}{6}$ again as wide as the prothorax and are about double the length of the head and prothorax together. The sculpture of the upper surface is conspicuously asperate though fine, and is so close that the surface might almost be called coriaceous rather than punctulate.

This species is much larger than those previously described except *T. pulchella*, Chap., from which it differs in colour and in

the uniform asperate puncturation of its upper surface, the elytra in *T. pulchella* being very finely striolate. The shortness and comparative coarseness of the pubescence in this species suggests the idea of a hairy surface that has been closely shaved. In some lights the prothorax shows a very faint dorsal impressed channel.

Port Lincoln; also on Yorke's Peninsula.

TOMYRIS NEGLIGENS, sp.nov.

Oblonga; minus nitida; cupreo-ænea; clypeo antice læte viridi marginato; subtus viridis; ore, palpis, antennis (articulo ultimo apice vix infuscato) pedibusque, flavis; corpore supra sat æqualiter confertissime subtiliter aspere punctulato, brevissime confertim aureo-pubescenti; sternis abdomineque dense albo-pubescentibus; oculis minus fortiter convexis; elytris postice haud abrupte declivibus. [Long. $2\frac{2}{5}$, lat. $1\frac{1}{5}$ lines.

Very closely allied to the preceding. The upper surface (under the pubescence) is much less shining and much less vividly coloured, and its puncturation (especially on the elytra) is markedly more asperate in character. The apex of the last antennal joint is hardly infuscate. The eyes are very much less prominent. The prothorax (viewed from above) appears to be less rounded on the sides and less narrowed in front; the true margin (which is invisible from above owing to the sides being strongly declivous) is seen when viewed from the side to be very little-different from that of *T. rasa* in curvature, but to have its angles with both the front margin and base much better defined; the hind angle is here almost a right angle, but in *T. rasa* is quite rounded off. The elytra are less abruptly declivous behind. The humeral calli are of a green colour. The 5th ventral segment in the male bears a large transversely quadrate excavation divided into two parts by an obscure carina which runs down its middle. The basal joint of the anterior tarsi in the same sex is scarcely dilated.

Yorke's Peninsula; unique in my collection.

N.B.—I have before me three specimens,—from another locality on Yorke's Peninsula,—which differ from the above in being smaller (long. $2\frac{1}{5}$ lines) and differently coloured, the colour varying from deep copper to a dull green, but they are all clothed with pubescence similar to that of *T. negligens;* the antennæ seem a little shorter than in that species, but as I do not observe any well-defined structural distinction it will be better to regard them as merely vars.

TOMYRIS OBSCURA, sp.nov.

Oblonga; minus nitida; nigra; antennarum articulis (ultimis 2 exceptis) basi obscure ferrugineis; corpore supra crebre subfortiter aspere punctulato, brevissime sparsius albido-pubescenti, subtus sparsim punctulato sparsim albido-pubescenti; oculis fortiter convexis; elytris postice sat abrupte declivibus.

[Long. $2\frac{2}{5}$, lat. $1\frac{1}{5}$ lines.

This species differs from all others known to me of the genus by its uniform black colour, varied only by a brassy green front of the clypeus, by very short white pubescence which is neither very close nor conspicuous, and by the ferruginous colour of parts of the antennæ. It is also notable for having its puncturation decidedly more rugulose on the elytra than on other parts, these organs presenting a slight appearance of striation on the disc and being strongly punctulate-striate, with elevated interstices, in the hinder half of the portion near the lateral margin, and their pubescence tending to run a little in longitudinal lines. The prosternum is evidently wider between the anterior coxæ than in *T. rasa* and most of its congeners. If this species be compared with *T. rasa* it will be seen that the eyes are slightly less prominent, that the prothorax is less convex and less rounded on the sides and that the elytra are much rougher in appearance with indications of striation which is entirely absent in *T. rasa.* The two or three joints of the antennæ preceding the last are somewhat compressed, and dilated from the base to the apex.

Port Lincoln.

TOMYRIS LÆTA, sp.nov.

Oblonga; sat angusta; subnitida; læte viridis, abdomine cupreo vel aureo-micante, labro, mandibulis, palpis, antennis (articulo ultimo apice obscuro excepto), pedibusque, flavis; corpore supra sat æqualiter confertissime subtiliter aspere punctulato, brevissime confertim aureo-pubescenti, subtus sat fortiter minus crebre punctulato, sat dense albo-pubescenti; oculis fortiter convexis; elytris postice minus abrupte declivibus. [Long. $1\frac{4}{5}$-$2\frac{2}{5}$, lat. $\frac{4}{5}$ (vix)-1 line.

Apart from colour, very like *T. rasa* but a narrower species, its elytra more closely finely and rugulosely punctulate, and its mesosternum very evidently narrower between the intermediate coxæ. From *T. obscura* it differs widely in colour, in sculpture, in the narrowness of the prosternum between the anterior coxæ, &c. From *T. viridula*, Er., which it resembles in colour, it differs in the very fine and close sculpture of the prothorax, &c. [The sexual characters are described under *T. impressicollis.*]

Yorke's Peninsula.

TOMYRIS GRACILIS, sp.nov.

Anguste oblonga; sat nitida; aureo-pubescens; viridis, abdomine cupreo-micante, labro, mandibulis, palpis, antennis (articulo ultimo apice nigro excepto), pedibusque, flavis; capite prothoraceque fortiter rugulose sat crebre, elytris confertim aspere minus fortiter, punctulatis; corpore subtus antice confertim, postice sparsius, punctulato; oculis sat fortiter convexis; elytris postice minus abrupte declivibus; prothorace transversim impresso; antennis corpore longioribus, articulo 4° 3° tertia parte longiori.

[Long. $1\frac{3}{5}$ (vix), lat. $\frac{3}{5}$ line.

The puncturation of the head and prothorax,—very much coarser and stronger than of the elytra,—will distinguish this species from most of its congeners, and the inequality *inter se* of the 3rd and

4th joints of the antennæ is also a strong character. The antennæ are decidedly, though not much, longer than the whole body. The transverse impression across the disc of the prothorax is well-defined and strong. In the male the whole middle part of the 4th and 5th ventral segments is occupied by a large deep excavation very like that in *T. impressicollis* but without the erect lateral processes. The basal joint of the front tarsi is very little dilated.

This species must be near *T. viridula*, Er., (from Tasmania), but as the author of that species expressly states that the 3rd and 4th joints of the antennæ are equal I must regard the two as distinct. Tasmania and S. W. Australia have so few species in common that I have no doubt other differences would appear if my example could be compared with Erichson's type.

Port Lincoln.

N.B.—A female (also from Port Lincoln) which I attribute doubtfully to this species is a wider insect, with antennæ scarcely differing from those of the male; its colour is coppery-æneous with greenish reflections.

TOMYRIS IMPRESSICOLLIS, sp.nov.

Oblonga; sat angusta; sat nitida; viridis vel æneo-viridis, abdomine aureo-micante, labro, mandibulis, palpis, antennis (articulo ultimo apice obscuro excepto), pedibusque, flavis; corpore supra confertissime subtiliter aspere (elytris minus aspere) punctulato, brevissime confertim aureo-pubescenti, subtus sat leviter minus crebre punctulato, minus dense albo-pubescenti; oculis fortiter convexis; elytris postice minus abrupte declivibus; prothorace transversim late impresso. [Long. $2\frac{1}{5}$, lat. 1 line (vix).

Very close to *T. læta*, but seems to be distinct. It differs from it as follows;—a more or less elongate shining elevated slender line runs down the middle of the clypeus; the colour is dull or brassy green rather than a bright clear green, and the general

surface is decidedly more nitid; the puncturation of the elytra is feebler, less asperate, and not so close, while that of the rest of the body is similar to that of *T. læta.* The prothorax has a very distinct, though not sharply defined, wide depression crossing the middle of the disc. On the underside the ventral segments are of a golden coppery colour. The sexual characters in the ventral segments, too, are different. One sex (apparently the female) in all the species of *Tomyris* that I have examined has the apex of the 5th segment widely and gently emarginate with its apical border a little thickened and reflexed. (This structure varies to some extent with the species but not in a manner that seems available for description). In the other sex of this species the 4th and 5th segments are occupied by a large deep common fovea of almost circular form, on either side of which near its apex are two stout blunt erect spines placed close together. In *T. læta* the 4th segment of the male does not present any peculiarity, but the 5th segment is of remarkable structure difficult to describe, appearing different in different lights. As far as I can ascertain a large square excavation occupies its middle part, but some parts stand up in this excavation to the level of the general surface, and these in some lights (when regarded obliquely) appear almost to fill up the excavation so as to give the appearance of the surface of the segment being cut up by a deep irregular channel. In this species also the basal joint of the anterior tarsi is very strongly dilated in the male, while in *T. læta* it is only slightly dilated.

Port Lincoln.

TOMYRIS LONGICORNIS, sp.nov.

Oblonga; sat angusta; minus nitida; æneo-cuprea; clypeo antice, elytris latera versus, capite subtus, coxis, metasternoque, læte viridibus; labro, mandibulis, palpis, antennis (articulo ultimo apice obscuro excepto), pedibusque, flavis; corpore supra confertissime subtiliter aspere punctulato, sat breviter sat confertim argenteo-pubescenti, subtus antice sat confertim postice sat sparsim leviter punctulato, sat dense albo-pubescenti; oculis sat fortiter convexis; elytris postice minus abrupte declivibus; prothorace

transversim late impresso; antennis gracilibus corpore vix brevioribus, articulo 3° 4° manifeste breviori. [Long. 2, lat. $\frac{4}{5}$ line.

A narrower and more slender insect than the preceding, and differently coloured, with longer and more slender antennæ, the pubescence on the elytra showing a decided tendency to run in rows; the prothorax is narrower, being not more than half again as wide as long. I have not seen a male of this species.

Port Lincoln.

TOMYRIS ÆNEA, sp.nov.

Oblonga; sat brevis; sat nitida; ænea vix cupreo-micans; capite plus minus viridi; labro, palpis, mandibulis, antennis (articulo ultimo apice obscuro), pedibusque, flavis; corpore supra subtiliter vix confertim sat aspere punctulato, setis brevibus argenteis suberectis minus confertim vestito, subtus sternis crebre sat fortiter, abdomine sparsius subtilius punctulato, obscure argenteo-pubescenti; oculis sat fortiter convexis; elytris postice minus abrupte declivibus; prothorace transversim late impresso; antennis corpore brevioribus, articulis 6-10 paullo compressis elongato-subconicis, 3° et 4° inter se æqualibus; capite inter oculos longitudinaliter carinato. [Long. $1\frac{1}{5}$, lat. $\frac{3}{5}$ line.

The front part of the disc of the prothorax is much less closely punctulate than the other parts of the same,—a very distinctive character. This species is very distinct from all previously described on account of its less crowded puncturation and (especially) the structure of its antennæ, which are stouter than in any of the preceding and have each of the five joints preceding the last slightly compressed and very gently dilated from the base to the apex so that the apical portion of the antennæ appears to be slightly serrate. This antennal character might possibly justify generic separation,—but as still more decided antennal modifications appear in the species next to be described I think its value of less importance than it appears at the first glance. The insect possesses all the essential characters of *Tomyris*,—prosternum evenly concave in front, claws appendiculate with the basal

piece very broad, posterior 4 tibiæ emarginate externally before the apex, body pubescent, apical joint of antennæ appendiculate.

In the male the 5th ventral segment is of very complicated structure and presents different appearances from different points of view; when looked at from vertically above it there is seen to be a rather small somewhat semicircular excavation occupying the whole length of its middle part, with a narrow longitudinal shining keel running down the middle of the excavation. This is not unlike the structure of the corresponding part in *T. negligens*, but in that insect the excavation occupies a larger area and is differently shaped, and the central keel is much wider and feebler. The basal joint of the anterior tarsi in the male is not much dilated. A female, which I believe appertains to this species, is somewhat larger than the male (long. $1\frac{2}{5}$ lines) and has the head unicolorous with the rest of the body, and antennæ not much longer than half the whole insect.

Port Lincoln.

TOMYRIS ANTENNATA, sp.nov.

Breviter oblonga; sat nitida; supra capillis argenteis erectis minus sparsim vestita; nigro-ænea, capite antice plus minus viridi; labro, mandibulis (his, nonnullis exemplis, apice infuscatis), palpis, antennis (articulis ultimis apice nigricantibus exceptis), tibiis (his plus minus infuscatis), tarsisque, brunneo-testaceis; capite prothoraceque (illo inter oculos carina nitida instructo) sat confertim, elytris sparsius, fortius punctulatis; corpore subtus pedibusque sat longe sat dense albo-vestitis; prosterno confertissime, metasterno sat confertim (medio sparsim), abdomine femoribusque sat sparsim, punctulatis; oculis sat fortiter convexis; elytris postice sat abrupte declivibus; prothorace vix transversim impresso; antennis corporis dimidio parum longioribus, articulis 6-10 sat fortiter compressis elongato-conicis, 3° et 4° inter se æqualibus. [Long. $1\frac{2}{5}$, lat. $\frac{7}{10}$ line.

The structure of the antennæ of this insect (the subapical joints of which are very little longer than their greatest width and give

the apical part of the antennæ a distinctly serrated outline internally), and their comparative shortness, distinguish it at once from all the above and from all previously described species of *Tomyris*. *T. œnea*, however, makes a manifest approximation in this respect and *T. obscura* shows indications in the same direction. I have seen only one sex (apparently female) of this species.

Port Lincoln.

TOMYRIS DIFFICILIS, sp.nov.

Oblonga; minus nitida; ænea, vix cupreo-micans; labro, mandibulis, palpis, antennis (articulis ultimis apice nigricantibus exceptis), pedibusque, flavis; corpore supra sat æqualiter confertissime subtiliter aspere punctulato, breviter sat confertim argenteo-pubescenti, subtus antice confertim aspere (postice sparsius vix aspere) punctulato, minus dense pubescenti; oculis sat fortiter convexis; elytris postice minus abrupte declivibus; prothorace transversim impresso; antennis corpore sat brevioribus, articulis 6-10 paullo compressis elongato-subconicis, 3° et 4° inter se æqualibus. [Long. $1\frac{2}{5}$ (vix), lat. $\frac{3}{5}$ lines.

The antennæ are shorter, and have joints 6-10 much more evidently compressed and dilated, than those of *T. œnea;* compared with those of *T. antennata* they are somewhat longer with less dilated joints. The puncturation of the upper surface distinguishes the present insect from both those just named, being very similar to the puncturation of some of the larger species of the genus,—especially *T. læta* and *negligens*. My two examples are both females.

Port Lincoln.

TOMYRIS (?) PARADOXA, sp.nov.

Late ovata; glabra; sat nitida; subtus picea, vix æneo-micans; supra æneo-cuprea; labro (hoc exemplis nonnullis infuscato), antennis (his apicem versus obscuris), palpis, pedibusque rufo-testaceis; capite verticali, prothoraci profunde insertum, crebre minus subtiliter (clypeo lævigato excepto) punctulato; oculis magnis minus pro-

minentibus, vix sinuatis; prothorace fortiter transverso, valde convexo, coriaceo, subtiliter minus crebre punctulato, antice in medio sat fortiter producto, margine laterali leviter arcuata; elytris quam conjunctim latioribus parum longioribus, prope suturam subtilius—inde latera versus gradatim fortius—punctulatis, inter hæc puncta subtiliter minus sparsim punctulatis, pone humeros vix transversim strigosis, intra marginem lateralem profunde sulcatis latitudine majori mox pone basin posita; scutello sat magno, quinquangulo, crebre subtiliter punctulato; femoribus medio dilatatis, anticis medio dente minuto acuto instructis; tibiis intermediis leviter, posticis vix perspicue, emarginatis; prosterno antice concavo, margine reflexo, inter coxas sat lato, fortiter elevato-dilatato pone; abdominis segmentis 2-4 gradatim brevioribus; corpore subtus subtilius sat sparsim (prosterno crassius crebre excepto) punctulato. [Long. 2 (vix), lat. $1\frac{1}{5}$ lines.

This and the next species cannot be regarded as genuine members of *Tomyris;* the glabrous body and different anterior margin of the prosternum would suffice to justify their separation,—but I think they are certainly allied to *Tomyris* and I am unwilling to give them a new generic name because they appear in many characters to agree so well with *Cleptor*, Lef., (placed by its author in the *Edusitæ*) that I cannot resist a doubt whether M. Lefèvre may not have overlooked the slight external emargination of the 4 hinder tibiæ and the peculiar anterior margin of the prosternum, and have founded his genus on a species congeneric with that now before me. This insect undoubtedly seems intermediate between *Tomyris* and *Edusia.* Its tibiæ,—although their external emargination is very feeble,—are those of *Tomyris.* The prosternum does not agree with that of either genus; it resembles *Tomyris* rather than *Edusia* in having no part of its front margin convex in a forward direction, but the whole of that margin is bent *upwards* (forming an increased receptacle for the head). The anterior coxæ are separated about as widely as in *Tomyris obscura,* the hind portion of the prosternum from the point where it begins to dilate hindward bring abruptly on a higher plane than the

anterior portion. The general facies is much like *Chrysomela* but the penultimate joint of the tarsi deeply bilobed is that of a *Eumolpid.* The antennæ are a little more than half as long as the whole body; joint 1 moderately elongate, piriform; 2 rather more than half 1; 3 more slender and slightly longer than 2; 4-6 equal to each other and scarcely longer than 3; 7-11 all lightly dilated.

Port Lincoln.

TOMYRIS (?) MINOR, sp.nov.

Late ovata; glabra; sat nitida; subtus piceo-viridis, latera versus lætius viridis; supra cuprea, capite viridi, prothorace antice aureo-viridi; labro, palpis, antennis, pedibusque testaceis; capite (clypeo excepto) crebrius sat fortiter, prothorace subtilius minus crebre, elytris ut *T. paradoxæ* sed fortius, punctulatis; scutello sublævi. [Long. $1\frac{2}{5}$, lat. 1 line (vix).

This small species scarcely differs from the preceding in its structural characters; the external emargination of the intermediate and hind tarsi is a little stronger, the front margin of the prosternum is not so distinctly turned up and the apical 5 joints of the antennæ are decidedly more dilated,—though in all of them the length decidedly exceeds the greatest width. The colour, the small size and the stronger puncturation readily distinguish it.

Port Lincoln; also on Yorke's Peninsula.

Besides the preceding species I have in my collection an unique example of a Tomyris from Yorke's Peninsula, and another from Port Lincoln, but as they are both females it will probably be better to pass them by for the present.

The following tabulation will show clearly I hope the distinctive characters of the species described above.

A. Prosternum normal..................................

B. Antennæ with each of the apical joints more than twice as long as its greatest width....

C. Legs testaceous..............................

D. Prothorax with a wide shallow impression across the middle..................

E. Antennæ long and slender; joints 6-9 sub-cylindric and not dilated........

F. Puncturation of prothorax almost uniform with that of elytra.......

G. Elytra coppery with lateral margins green........................ *longicornis.*

GG. Elytra entirely green .... *impressicollis.*

FF. Puncturation of prothorax (especially in front) much coarser than of elytra.......................... *gracilis.*

EE. Antennæ with joints 6-10 evidently compressed and elongate-triangular .... *ænea.*

DD. Prothorax not impressed across the middle...............................

E. Eyes at least normally prominent.....

F. Mesosternum wide between intermediate coxæ...................... *rasa.*

FF. Mesosternum narrow .... *læta.*

EE. Eyes exceptionally slightly prominent................................. *negligens.*

CC. Legs black or nearly so.................... *obscura.*

BB. Antennæ with some of the joints not, or scarcely, twice as long as their greatest width......................................

C. Clothed with erect (and not particularly short) hair.................................. *antennata.*

CC. Clothed with close short pubescence....... *difficilis.*

AA. Prosternum abnormal.............................

B. Head coppery...................................... *paradoxa*

BB. Head bright green................. .... *minor.*

EDUSOIDES, gen.nov.

Corpus oblongum, plus minus sat longe pubescens. Caput subverticale usque ad oculos thoraci insertum, oculis subintegris. Antennæ corporis dimidio subbreviores, articulis 5 ultimis moniliformibus. Prothorax fortiter transversus, lateribus integris. Scutellum sat transversum, quinquangulum. Elytra haud costata. Prosternum sat latum postice dilatatum truncatum, episternis antice vix perspicue convexis. Femora inermia, medio sat fortiter dilatata. Tibiæ validæ, breves, simplices, apice externe fortiter dentatæ. Tarsi robusti (maris posticorum 4 articulo primo valde dilatato). Unguiculi appendiculati, divaricati.

The following species cannot be referred to any hitherto characterised genus known to me; I am therefore compelled to find a new name for it. Although its facies is decidedly suggestive of *Edusia*, its place in Dr. Chapuis' classification would be difficult to assign, as the front margin of the prosternal episterna is so slightly convex and its inner angle so very slightly marked that I question whether the insect could be placed in the *Edusites;* the hinder tibiæ are not emarginate externally, the claws are appendiculate and the sides of the prothorax are entire.

EDUSOIDES PULCHER, sp.nov.

♂.—Oblongus; minus nitidus; supra alutacius; viridis, aureomicans; labro, palpis, antennis (his apicem versus infuscatis), pedibusque, testaceis; capite confuse minus subtiliter, prothorace sparsius subtilius, elytris obscure crassius, punctulatis; subtus sat nitidus, aureo-viridis, longe minus crebre pubescens, metasterno

fortiter transversim rugato; abdomine transversim acervatim punctulato, segmento ultimo late fortiter emarginato; tarsorum anticorum 4 articulo basali fortiter dilatato.

[Long. $1\frac{1}{5}$ (vix), lat. $\frac{3}{5}$ line.

The joints of the antennæ are all more or less bead-like,—the basal joint the largest, the second about a half smaller, the next four all smaller still but not differing much *inter se*, the apical five joints almost equal *inter se* and each a little smaller than the basal joint,—the 11th, however, a little longer (though not stouter) than the preceding. The legs are very stout, all the femora being strongly dilated in the middle, the tibiæ widening considerably to near the apex and then abruptly dilating at the extreme apex externally in a very strong and very sharp tooth. The basal joint of the four anterior tarsi is very large being about as wide as long and about as wide as the dilated apex of the tibia. The claws are appendiculate, the basal piece of the claw being produced in a sharp tooth internally. The elytra have some obscure transverse wrinkles behind the shoulder, and are feebly striate near the apex with feebly convex interstices.

Sent to me from Western Australia by E. Meyrick, Esq.

N.B.—The specimens of the preceding sent by Mr. Meyrick were accompanied by some females evidently congeneric, but I do not think certainly conspecific. They are larger and broader [long. $1\frac{3}{5}$, lat. 1 line (vix)], of a dark æneous colour, with the antennæ more slender, the joints of the same (especially joints 3-7) less bead-like, the pubescence much longer and more conspicuous on the underside and invading the sides of the upper surface, the external tooth on the tibiæ even longer, and of course the basal joint of the posterior four tarsi not dilated, nor the apex of the 5th ventral segment strongly emarginate. The convexity of the front of the prosternal episterna appears to be a trifle more pronounced in these females than in the male described above.

CHALCOMELA ILLUDENS, Baly.

The habitat of this species is given by its author as "? Adelaide." I have seen no insect agreeing with the description in the numerous South Australian collections that have come under my notice,—but examples have been sent to me, taken near Brisbane by Mr. Bailey, which answer to the description very fairly. The description of the purple markings on the elytra corresponds a little doubtfully with the markings of the examples in question, but those markings are so ill-defined and in some lights agree so fairly well that I think my identification is correct.

STRUMATOPHYMA UNDULATIPENNIS, Clk.

I have met with an insect near P. Lincoln which agrees very well with Mr. Clark's description, and differs from *S. verrucosa* as *undulatipennis* is said to do,—except in the absence of the reddish colour attributed to the sterna and antennæ of the latter species. This discrepancy may arise from Mr. Clark's having described a somewhat immature specimen. *S. undulatipennis* was described on a unique example from W. Australia.

CHALCOLAMPRA ADELAIDÆ, sp.nov.

Brevis; ovalis; nitida; nigro-ænea; ore, antennis, palpis, pedibusque testaceis; prothorace duplo-punctato; elytris striato-punctulatis, interstitiis subtiliter punctulatis.

[Long. 2, lat. $1\frac{1}{5}$ lines (vix).

Not unlike the European *Prasocuris aucta*, Fab., in shape, but a little more attenuated and prolonged behind. The entire upper surface is finely, evenly and closely punctulate,—the coarser sculpture being superadded to this system of fine even puncturation. The head is in some examples more or less red; the clypeus is separated from the front by a strong arched impression. The prothorax at the base is nearly twice as wide as it is long, the base being a

little less than half again as wide as the front which is gently concave, with obtuse angles; the sides are nearly straight from the base to beyond the middle, and then arcuately convergent; the base is gently bisinuate, widely roundly and rather strongly lobed in the middle, and very exactly applied to the elytra; the hind angles are well-defined; the coarser puncturation is in the middle sparing, and not much coarser than that of the general surface, but is larger and closer towards the margins. The elytra are very distinctly punctulate-striate quite to the apex, the interstices being almost perfectly flat. The claws are not far from being simple, the basal tooth being ill-defined, feeble, wide and very obtuse. The 3rd joint of the antennæ is considerably longer than the 4th.

This insect must be near the Tasmanian *C. pacifica*, Er., and *luteicornis*, Er., from both of which (apart from colour differences) it differs in having the sculpture of the elytra not obsolete near the apex; from *C. acervata*, Germ., it differs in colour, shape and sculpture as well as size.

Not rare near Adelaide; generally found (like most of its congeners) under bark.

CHALCOLAMPRA HURSTI, sp.nov.

Robusta; nigro-ænea; sat nitida; capite (nonnullis exemplis), ore, palpis, antennis, pedibusque piceo-rufis (his, plurimis exemplis, obscurioribus); prothorace duplo-punctulato; elytris sat fortiter punctulato-striatis; interstitiis late leviter inæqualiter convexis, lævigatis. [Long. $3\text{-}3\frac{1}{5}$, lat. $1\frac{3}{5}$ lines.

The antennæ are decidedly less than half as long as the whole insect, and slender, their 3rd joint much longer than the 4th which is equal to the 5th. The prothorax is considerably more than half again as wide as long, its base about half again as wide as its front which is rather strongly concave; the sides are contracted in a gentle curve from base to apex; the surface is covered with very fine lightly impressed and by no means close puncturation,

and also bears a system of coarser (but not very coarse) punctuation which is rather evenly distributed (except on the hinder part of the disc where it fails), and is not much coarser on the sides than elsewhere. The elytral sculpture is scarcely enfeebled towards the apex. The interstices are for the most part very evidently convex but in an irregular fashion some parts of the same interstice being more convex then others, and the convexity being here and there extended laterally so as almost to interrupt the striation; all these irregularities however are feeble and not at all sharply defined, but they give the elytra a somewhat blotchy appearance. Compared with *C. repens*, Germ., this species (apart from colour differences) has the antennæ much more slender, the joints of the same differently proportioned *inter se*, the prothorax less transverse and differently punctured, the elytral interstices less evenly convex, &c., &c.,; compared with *C. acervata*, Germ., (which is supposed to be identical with *ænea*, Boisd.) it presents similar antennal differences, its prothorax differs by the concavity of its front margin, the much greater closeness and evenness of its coarser system of puncturation, &c., &c., and the elytra by the convexity of their interstices. Two species have been previously recorded from Queensland,—*C. marmorata*, Baly, which has yellowish elytra sprinkled with piceous patches,—and *C. rufipes*, Jac., which has the prothorax very sparingly punctulate, besides colour differences.

Taken near Brisbane by Mr. Hurst; several specimens.

N.B.—Specimens taken in the Adelaide district, also on Yorke's Peninsula and near P. Lincoln, appear conspecific with this, although the brassy tinge of colour on their upper surface is more decided and they seem te be a little more convex longitudinally,—the elytra viewed from the side presenting an upper outline which forms a more decided curve; in some of these examples, moreover, the elytra are more or less opaque and finely coriaceous,—the latter character being possibly sexual.

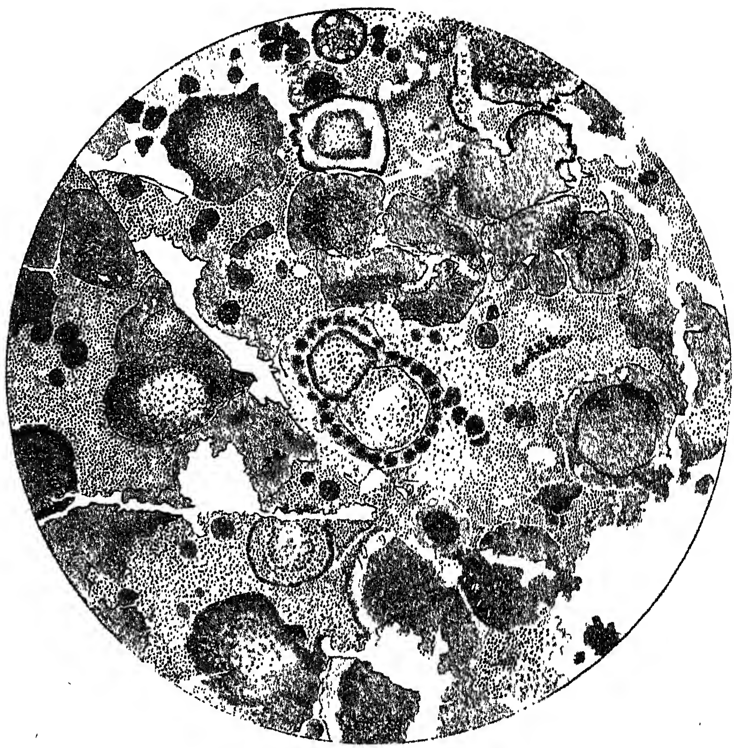
CHALCOLAMPRA DISTINGUENDA, sp.nov.

Minus convexa; nitida; ænea; antennis pedibusque nigro-piceis, abdomine apice rufescenti; prothorace acervatim crassissime punctulato; elytris seriatim punctulatis; punctis in seriebus sat subtilibus, sparsim positis, apicem versus obsoletis; antennis robustis, articulis 3° 4°-que inter se æqualibus.

[Long. $3\frac{2}{5}$, lat. $1\frac{4}{5}$ lines (vix).

The only other previously described species resembling this in having dark coloured legs and antennæ (the latter being stout) and elytra devoid of markings are *acervata*, Germ., *repens*, Germ., and (perhaps) *pacifica*, Er. Of these the last-named is a very much smaller insect; *acervata* is decidedly smaller and *repens* considerably larger. *C. distinguenda* differs moreover from all three *inter alia* in having elytra quite devoid of striæ, the punctures being simply inserted in rows on an even surface. The interstices between the rows are quite lævigate.

Victoria; unique in the S. Australian Museum.



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P. T. Hammond del. SPORANGIA (?) in Fireclay. Baron & Gatward lith.

NOTE ON THE ORIGIN OF "KEROSENE SHALE."

By T. W. Edgeworth David, B.A., F.G.S.

(Plate xviii.)

Introduction.—The so-called kerosene shale of New South Wales has been more appropriately termed Torbanite by the late Rev. W. B. Clarke.*

Professor Liversidge has also adopted the same name for it, remarking that the oil which it contains is probably not kerosene, and that the fracture in most cases is conchoidal and not shaly, the only exception to the latter rule being the small patch of oil shale formerly worked at America Creek, near Wollongong.†

The first mention of the discovery of kerosene shale, according to Liversidge *(loc. cit.)*, is that made by P. Cunningham, Surgeon, R.N., in a book entitled, "Two Years in New South Wales," published in London in 1827, where he describes its occurrence near Bathurst. Since that date kerosene shale has been proved to exist in many localities in this colony, of which the most important are the following:—Colley Creek, near Murrurundi and Greta in the Northern Coal-field, and in the same field in the *Greta Coal Measures*, at Homeville, near Stony Creek, West Maitland, it is represented by a seam of cannel coal; Hartley, Blackheath, Katoomba, Mt. Victoria, Mt. York, Burragorang, Wallerawang, Capertee, Bathgate in the Western Coal-field; Joadja Creek in the South-western Coal-field, and Mount Kembla, America Creek near Wollongong, and the head of the Clyde River in the Southern Coal-field.

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* Remarks on the Sedimentary Formations of New South Wales, Sydney, 1878, p. 66.

†Minerals of New South Wales, &c., by A. Liversidge, M.A., F.R.S., London. Trübner & Co., 1888, pp. 145-153.

The kerosene shale at each of these localities is believed by Mr. C. S. Wilkinson, F.G.S., the Director of the Geological Survey, to occur in the *Lower Productive Coal Measures*, otherwise known as the *Greta Series*, of Permo-Carboniferous age, and this fact first recognised by Mr. Wilkinson may prove a valuable help in the correlation of the different Coal-fields of New South Wales.

Occurrence.—Kerosene shale is developed in isolated patches for the most part near the edge of the basin of the *Lower Productive Coal Measures* of New South Wales. In certain coal seams it is associated with the coal, and occasionally passes rather suddenly into ordinary bituminous coal, Mr. C. S. Wilkinson having observed one instance where the transition occurred in the space of three feet.

The change from kerosene shale into bituminous coal can be traced vertically in the seam as well as horizontally. Mr. W. A. Dixon, F.I.C., F.C.S., in a paper read before Section B. of the Australasian Association*, calls attention to the fact that at Joadja there are three distinct layers in the kerosene shale seam, a lower layer of splint coal, a middle layer of kerosene shale, and an upper layer of good bituminous coal, and remarks (*loc. cit.*), "It is evident that the differences in the three layers in this seam cannot be ascribed to any other causes than an originally radical difference in the vegetation forming them."

In other cases, however, these lenticular patches become stony near the margins, and pass into a very fine-grained black carbonaceous clay shale, having a splintery conchoidal fracture. These patches vary in extent from a few square feet to perhaps over a square mile, and in thickness from a few inches to five feet. The kerosene shale, though at first sight it appears to be massive, is in reality minutely laminated, as may be observed if the weathered outcrops of the deposit be examined. The laminæ occasionally show imprints of *Glossopteris* and *Vertebraria*. The former are

* Proceedings of Australasian Association for the Advancement of Science. First Session, 1888, p. 127.

found to conform to the planes of lamination, whereas the latter, as I am informed by Mr. C. S. Wilkinson, are almost invariably found at Joadja to lie with their longest axes at right angles to the planes of bedding, so that they must have been growing in an erect position at the time that the kerosene shale was being formed. Professor Liversidge also mentions this fact (*loc. cit.* p. 146). Mr. Wilkinson also informed me that the substance of the *Vertebraria* in these shales is usually found to be converted into jet.

Where of an inferior clayey character the shale contains great numbers of spherical bodies sprinkled through it, about the size of a small pin's head, and about 1-50th to 1-40th of an inch in diameter. In places these pin-head bodies are represented by hollows of about the same size, or a trifle smaller, partly filled with a brown resinous-looking powder. This has been observed by the author at Iron Creek, near Mittagong, and also in the core from the recently completed bore at Woodford, in the Blue Mountains.

At the Homeville colliery, at Stony Creek, near West Maitland, a band of fire-clay occurs in association with the main seam of cannel coal, which here represents the kerosene shale; and this fire-clay contains spherical bodies about 1-40th of an inch in diameter in such abundance as to constitute about $\frac{1}{4}$th of the whole rock. They consist of earthy ochreous limonite, and become magnetic on being heated to bright redness in the blowpipe flame. Microscopic sections, however, prepared at the Department of Mines, and exhibited by kind permission of the Minister for Mines, show that these bodies, which at first sight might be supposed to be minute concretions, are probably minute fossils. Their spherical shape suggests that they may belong to sporangia, or seeds, or possibly large spores. They appear to consist of three parts—an amorphous nucleus, surrounded by a thick zone having more or less of a fibrous radial structure, which last is encased in a narrow opaque ring which forms the outer envelope of these bodies. Were they concretions there would probably be less uniformity in their size, and they would

be not so much indented, as they are, into the fossil leaves with which they are associated.

Mr. W. A. Dixon (*loc cit.* p. 133) requotes a statement of his from Professor Liversidge's "Minerals of New South Wales" with regard to a coal from Mittagong, which the author knows to be intimately associated with the kerosene shale, to the effect that "the bright lines of fracture were marked by numerous lens-shaped cavities 00·5 to 0·10 inch in greater diameter, generally filled with a brownish pulverulent carbonaceous matter. These were apparently the impressions and remains of seeds, and they showed traces of a dense cortical layer." Mr. C. S. Wilkinson informs the author that he has observed numbers of similar sporangia or seeds associated with, he thinks, the Lower Lithgow seam at Bowenfels. Microscopic sections of the kerosene shale itself show that it consists largely of numerous flat, elongated, and round or oval particles, some of which at any rate may be referred to spores, spore-cases, or seeds.

Fossil wood is conspicuously absent from the *Lower Coal-Measures* in which the kerosene shale occurs. A few fragments, however, are occasionally met with near Maitland in the Ravensfield Sandstone of the *Lower Marine Series,* which underlies, and in some of the beds of the *Upper Marine Series,* which overly the *Lower Coal Measures.* There is no evidence, however, of the existence of large roots or stools of trees in the underclays of the kerosene shale or cannel coal, such roots as do exist being somewhat minute.

The following is a section by Mr. J. Mackenzie, F.G.S., of the kerosene shale seam at Joadja, near Mittagong, in this colony* :—

(Roof) Conglomerate.	Ft.	In.
Bituminous Coal	0	8
Boghead Mineral	1	0
Indurated Clay	0	1
Boghead Mineral	1	0
Coal and Shale (hole in this)	1	6

* Mineral Products of New South Wales, &c., and Description of the Seams of Coal Worked in New South Wales, by John Mackenzie, F.G.S., 1887 edition, p. 176.

With this it may be of interest to compare a descending section of the Torbanehill seam in Scotland by Thomas Stuart Traill, M.D., F.R.S.E.*

1. "A thick roof of sandstone.
2. *Faeks*, a crumbling shale = 4 inches in thickness.
3. *Cement*, a mixture of shale and poor ironstone = 3 inches.
4. *Bitumenite*, which in this pit at the face = 1 foot 4 inches in thickness (elsewhere 1 foot 11 inches, T.W.E.D.).
5. Fine ironstone from 2 inches to $\frac{1}{2}$ inch.
6. Bituminous shale often containing tabular masses of good ironstone = 2 inches.
7. An inferior coal = 7 inches. These four last-mentioned beds are all raised with the Bitumenite, and together measure 2 feet 3 inches in thickness.
8. Coal much mixed with shale, here called *foul coal*, about 2 feet 4 inches.
9. Fireclay."

The "Bitumenite" above is a synonym proposed by Dr. Traill for Torbanite.

On p. 10 *(loc. cit.)* he states that large *Stigmariæ* occur in the Torbanite, one as thick as a human body, and also that no real organic structure was visible in the Torbanite, but numerous globules of a pale yellowish matter. In the same publication, p. 176, Dr. John Hughes Bennett, M.D., F.R.S.E., describes minute transparent bodies in the Torbanehill Mineral having a radiate crystalline appearance, and being from $\frac{1}{200}$th to $\frac{1}{4000}$th of an inch in diameter. He states (*loc. cit.* p. 181) that these yellow masses in the Torbanehill Mineral are a "bitumenoid or resinoid substance, imbedded in earthy matter;" and also that "We could nowhere discover in them any trace of cell wall or contents. . . . Numbers of them present no envelope or definite boundary."

* Trans. Roy. Soc. Edinburgh, xxi. Part 1, p. 8.

Chemical Composition—Mr. W. A. Dixon in his above-quoted papers, page 135, gives the following as an analysis of the best Joadja shale :—

Carbon	75·32
Hydrogen	12·05
Oxygen	5·49
Nitrogen	0·28
Sulphur	0·31
Ash	6·55

On the preceding page of the same paper, Mr. Dixon says, "It has been suggested by some one that the shales are the products of resinous spores of some plant. From the persistent fatty products of distillation, I think resin must be abandoned, as resins pass more to aromatics. It appears to me more probable that shale comes from some oil or wax producing plant, more likely the latter, in view of the considerable yield of solid paraffin." On p. 137 of the same paper, Mr. Dixon states that "the organic matter of the shale is evidently a very stable body. It is almost absolutely insoluble in naphtha, carbon bisulphide and similar menstruæ."

Professor Liversidge states *(loc. cit.*, p. 145*)*—"The Hartley and Murrurundi shales are but slightly soluble, if at all, in alcohol, ether, carbon disulphide, petroleum or caustic potash, even when boiled; but they gelatinise with boiling sulphuric acid, and evolve a sulphurous acid odour; with nitric acid they yield a yellow solution."

On p. 148 *(loc. cit.)*, the same authority gives the following analysis by himself of kerosene shale from Joadja Creek, and, amongst analyses of other similar minerals for comparison, one by How of the Torbanite, from Torbane Hill :—

Locality.	Moisture.	Volatile Hydro-carbons.	Fixed Carbon.	Ash.	Sulphur	Specific Gravity.
12. Joadja Creek, N.S.W.	0·04	82·123	7·160	10·340	0 337	1·229
25. Torbanite, Torbane Hill...	......	71·17	7·65	21·18	......	1·170

Previous Theories about its Origin.

(1) *Drift Timber Theory.*—With reference to the origin of kerosene shale, the late Rev. W. B. Clarke* states that "it has unquestionably resulted from the local deposition of some resinous wood, and passes generally into ordinary coal, many portions of the same bed in the Illawarra mines exhibiting the unmistakable features of the latter and the impress of fronds of *Glossopteris* as plainly as they are shown on ordinary coal shale." On the following page Mr. Clarke states, "presuming that the origin above suggested is correct, viz., the occasional occurrence in the ancient deposits of trees of a peculiar resinous constitution, there is no anomaly in finding in one spot a mere patch amidst a coal seam (as is the case at Anvil Creek on the Hunter River), or thick-bedded masses of greater area as in the coal seams of Mount York, or of American Creek in the Illawarra, depending on the original amount of drift timber." This theory is the one at present most generally accepted.

(2) *Distillation Theory.*—The late Examiner of Coalfields, Mr. Wm. Keene, F.G.S., was of opinion that kerosene shale owed its origin to a natural distillation of the hydrocarbons from bituminous seams through the heat of igneous rocks intruded into the coal-measures subsequent to the formation of the coal-seams. He considered, therefore, that igneous rocks of later date than the coal-measures formed everywhere a necessary accompaniment to kerosene shale.

(3) *Oil-spring Theory.*—The late Professor Denton, when in Sydney a few years ago, suggested that kerosene shale was due to local outbreaks of oil-springs, which may have overflowed at the surface and saturated the peaty material in the coal-swamps for a considerable radius around the scene of the outbreak. This explanation, however, simply puts the difficulty back a stage, but

* Sedimentary Formations of New South Wales, Sydney, 1878, p. 66.

does not remove it, as the obvious question at once suggests itself, What caused the oil-wells? and of this no satisfactory account can be given.

It might be argued that such oil-wells might have had an origin similiar to those of Trinidad, which are associated with the famous Asphaltum Lake of La Brea. At Trinidad, however, the oil and asphaltum is considered by Messrs. S. P. Wall and J. G. Sawkins, F.G.S.,* to have originated from the alteration *in situ* of ligneous deposits, together with, perhaps, a slight admixture of animal material, especially shells. They consider the Asphaltum Lake of La Brea, which has a superficial area of 99⅓ acres, and is estimated to contain about 3,168,000 tons of bitumen (the average depth being supposed to be 20 feet), to have resulted simply from a segregation and concentration of the bitumen in local depressions in the asphaltic sands and shales.

The same authors state (*loc. cit.* p. 144) :—"The conversion from the ligneous into the bitumineous structure may be seen in any stage, from the first deposit (usually parallel with the fibres) to the total obliteration of organic texture, when nothing but the external form of the wood remains." They conclude that asphaltum has been formed from vegetable material by direct conversion at the ordinary temperature. The same stratum may be lignitic at one point, and asphaltic at another, the difference being attributed to the different chemical reactions which have taken place, the tendency being for lignite to be formed, where the deposit is of a pure carbonaceous nature, and asphaltum, where a large proportion of earthy matter exists. The first stage in the process of conversion of woody matter into asphaltum consists in the formation of asphaltic oil; this oil rises in springs from comparatively shallow depths. The residue after the separation of this oil is usually the ordinary asphalt.

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* "Memoirs of the Geological Survey of the West Indies." Part I. "Report on the Geology of Trinidad." By S. P. Wall and J. G. Sawkins, F.G.S., 1860, pp. 143-147.

Vegetable Secretion Theory.—This theory was advanced by Mr. W. A. Dixon in his paper already quoted (pp. 135 and 136), and the similarity in the chemical composition of some waxes of living plants to that of kerosene shale, as Mr. Dixon points out, lends some weight to this argument.

It may be not out of place here to mention that Mr. Hamlet, F.C.S., the Government Analyst, stated at the last meeting of the Royal Society that the fact had lately come under his notice that a considerable quantity of oil had lately been observed to be floating on the surface of the reservoir at the waterworks at West Maitland. This oil, in Mr. Hamlet's opinion, was produced by a small aquatic plant, *Spirogyra* or *Protococcus*, but he was not prepared to say whether the oil was secreted by the plant, or whether it was connected with fructification. He was inclined to the former opinion.

Coorongite Theory.—The author is informed by Mr. C. S. Wilkinson that he believes that it has been suggested that kerosene shale may have had an origin similar to that of the *Coorongite* found at Coorong, in South Australia. The author, however, has been unable to find any reference to such suggestion.

Coorongite is described by W. T. Thiselton Dyer, B.Sc., F.L.S.,* as "a peculiar indiarubber-like material, . . . the history and origin of which seem likely to become matters of as great controversy as the true nature of the Torbane Hill Mineral. In appearance it consists of sheet-like masses somewhat less than an inch in thickness, and with more or less scattered sand-grains adhering to their surface. It occurs at a place called Coorong, whence it is brought to Adelaide. The country in the neighbourhood is described as consisting of limestone ridges and scrub without grass. The Coorongite, as it has been named, is confined to a depressed portion of the district, the bottom of which is sandy and grass-covered; it occurs on the banks forming the

* "On a Substance known as Australian Caoutchouc." Journal of Botany, 1872, pp. 103, 104.

margins of the depression, and also on the sides of island-like elevations which are scattered about it." On page 104 (*loc. cit.*) he states, "Another writer in the *Register* (May 8th, 1866) describes thin sections as 'exhibiting under the microscope, especially if moistened with a solution of caustic potash or benzole, a granular and cellular structure with entangled fibres resembling the fibres of decayed fungi.' Mr. Berkeley has also, as he informs me, been struck with this pseudo-cellular structure. Mr. Archer, the Secretary of the Dublin Microscopical Club, to whom I submitted a fragment for examination, gives, I think, the true explanation of this appearance. He writes to me in a recent letter to the following effect:— 'I think the substance in question is certainly organic—some kind of gum with accidental things imbedded, such as bits of vegetable tissue, some confervoid or fungal threads, and the like. Once I saw a *Cymbella* in the material, but I never could find the same place again. The matrix appears to possess a certain amount of *quasi* cellular appearance by reason of streaks running here and there in a *quasi* reticulated manner. Of course, in the act of making the section, the knife leaves a number of superficial streaks which one must throw overboard.' The structure of the matrix noticed above may doubtless be attributed to a physical fibrillation due to the mere shrinking and hardening of the substance. That it must have been in a soft, if not fluid state, is evident from the miscellaneous collection of cryptogamic *reliquiæ* which different microscopists have detected in it. Their miscellaneous character is a sufficient proof that their presence is adventitious. As to the origin of the substance, opinions are the most discordant possible. The suggestion which occurred to Mr. Berkeley that it is the residue of some cryptogamic plant, is, at first sight, very plausible. One can imagine such a residue being formed by *Bromicolla aleutica*, which forms in the Aleutian Isles a layer two feet thick of a Nostoc-like substance, covered with a gramineous vegetation. One can imagine it also to result from the drying up of a lake covered with *Hoomonema fluitans*, the 'vegetable turtle-fat,' described by

Dr. Seeman as a jelly-like mass several feet thick, with a tall species of sedge growing in it. The following analysis made by Dr. Bernays discountenances, however, this theory entirely.

He found :

Moisture	·4682
Carbon....................................	64·7300
Hydrogen.................................	11·6300
Ash	1·7900
Oxygen and unestimated matters....	20·3768

Any residue left by a Cryptogam (assuming, of course, that no extensive change of composition had taken place in it, except the loss of water) would contain about 50 per cent. oxygen, or far more than the *whole* of the unestimated matter put down above; it would also contain much less hydrogen. It may, therefore, be safely concluded that no cryptogamic growth could have produced a substance which is practically a hydro-carbon and not a carbo-hydrate."

Professor Thiselton Dyer concludes that coorongite may be the oozing or secretion of some plant like the grass-tree (*Xanthorrhœa*) or it may have been formed from petroleoid springs. The diatoms found in the coorongite are all freshwater species, as the author is informed by Mr. J. J. Fletcher, M.A., B.Sc., to whom he is indebted for the above reference to Professor Thiselton Dyer's paper, and also for the following reference to a description of the diatoms associated with coorongite.*

Mr. R. Etheridge, jun., has also kindly supplied the author with the following references to coorongite.†

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* Quarterly Journal of Microscopical Science. Vol. XIII. New Series, p. 211. "The diatoms in the Australian Caoutchouc, &c," by the Rev. E. O'Meara.

† Coorongit, a New Australian Mineral Product. Baird's Annual Record of Science and Industry for 1872, p. 134.

Coorongit. Das Australische Kautschuk Coorongit. Der Naturforscher, 1872, V. No. 23, p. 186.

The author has been unable to get access to the two last-mentioned works, but these references may perhaps be of use to others.

The many points of resemblance between coorongite and kerosene shale may serve as an excuse for the author having introduced so lengthy a quotation as to its nature and probable origin. So long, however, as these remain a mystery, their exact bearing, if any, on the origin of kerosene shale, must remain in abeyance.

Arguments against Drift Timber Theory.—(1) Had kerosene shale been formed from rafts of resinous trees, which became macerated at the spots where we now find kerosene shale, it is unlikely that the maceration should in every case have been so thorough and complete as not to leave a vestige of woody structure behind. At Trinidad, for instance, as already related, the wood in the asphaltic deposits exhibits every gradation of change from the ligneous into the bitumenous state, so that if the whole deposit were buried under thick sediments for a long geological period until it became completely fossilized, and were afterwards re-exposed by denudation, there would be ample proof of the formation of bitumen from woody matter in the fragments of the undecomposed and partially decomposed woody material in the rocks associated with the bitumen, and the latter would also contain pseudomorphs in bitumen after the original individual fragments of wood. In the case, however, of the kerosene shale seams of this colony fragments of fossil wood are rarely found in the strata immediately associated with the kerosene shale seams.

(2) It is difficult to understand how *Glossopteris* leaves could have become so delicately interleaved with the laminæ of the kerosene shale, or the *Vertebraria* stems have maintained their erect position in the kerosene shale, supposing it to have originated from a mass of drift wood. Such leaves would in the case supposed have been chiefly restricted to the top of the mass, and would not have been evenly distributed through it, as they are now found.

(3) The resins in such trees, during such supposed maceration, would be liable to separate out in places into small irregular

patches and lumps, like the retinite in the altered brown coal of Invercargill and Kawa Kawa, Bay of Islands, New Zealand, but such do not as a rule occur in the shale.

(4) Drift timber would be sure to carry fragments of rock or lumps of earth entangled in its roots, and these would be liable to be imbedded in the shale, during the process of maceration, but this is not found to be the case.

(5) The results of the decomposition of resinous trees would probably be to produce some true resin, but from the reports above quoted of Mr. Dixon and Professor Liversidge, kerosene shale is not appreciably soluble in alcohol, ether, or bisulphide of carbon, and it certainly would have been partly soluble had it contained resin in large proportion.

Arguments against Theory of Distillation by Intrusive Igneous Rocks.—(1) In some cases, as at Greta, kerosene shale has been found far removed from intrusive igneous rocks.

(2) At Joadja, if the shale had resulted from distillation, the seam would have had a tolerably uniform composition, instead of being separated into three distinct layers.

(3) Oil would be found in the crevices and interstices of the rock wherever it is at all porous. But this has not been observed.

Arguments against Oil-spring Theory.—These would be the same as those already advanced against *drift-timber theory*, with the exception of (4) and (5), and with the additional objection that there would be no apparent source for the oil-springs.

Arguments against Vegetable Secretion Theory.—No valid arguments have occurred to the author against this theory, with the exception that it does not fully account for the very lenticular character of the shale, nor from its development being chiefly confined to the edge of the coal basin. It appears, however, by far the best of the theories already advanced, and may be the correct one, though the author thinks that there is more evidence in favour of his own theory.

Arguments for and against Coorongite Theory.—The origin of Coorongite being not yet understood, it is useless to speculate as to a possible similar origin for the kerosene shale, though the latter certainly possesses some striking points of resemblance to the former, especially if allowance be made for the elimination of oxygen, which would take place in Coorongite were that mineral subjected to such prolonged conditions of heat and pressure as the kerosene shale has undergone.

Suggested Theory of Kerosene Shale having been formed from Sporangia, Spores, Pollen, or Seeds.—The minute lamination of kerosene shale, and the uniform distribution throughout it of the minute resinous-like particles, taken in conjunction with the fact that fossil leaves are regularly interlaminated with the shale, especially where it is at all inferior, lead the author to infer that the finely divided state of the kerosene shale was of primary and not of secondary origin. If the resinous-like particles were originally in a finely divided state, the most natural assumption is that they were spores, sporangia, pollen, or seeds. A microscopic examination of the clay shales associated with the cannel seam at Homeville shows them to contain abundant spherical bodies, about 1-30th of an inch in diameter, which are probably sporangia. Somewhat similar bodies are observable in inferior portions of the kerosene shale, and possibly even in purer varieties. It is possible, therefore, that the oily character of these shales may be chiefly due to the local accumulations of showers of minute spores or sporangia or seeds, with a certain admixture of peaty material from the swampy ground in which the coal was found.

What was the nature of the plants which supplied these small spherical bodies is at present unknown. Probably they did not belong to the genus *Glossopteris*, for had they been derived from a plant so universally distributed as this is throughout the *Lower Coal Measures*, kerosene shale would probably be less restricted in its occurrence than we now find it. Perhaps these minute bodies were derived from plants which grew on the hills which fringed

the coal basin. This supposition would, if correct, explain the fact that kerosene shale is chiefly restricted to the edges of the coal basin. Wind blowing off the hills would be apt to carry with it spores from cryptogamic plants, and deposit them over the swampy flats of the coal basin, much in the same way that the pollen from the catkins of the fir is blown over the pine forests and lakes of Scotland, Scandinavia, and Canada, as described by Dr. John Davy.* Such deposits, even at the present day, frequently attain a thickness of half an inch. Where the pollen shower falls on earth it soon becomes mixed with the decayed vegetation and earthy impurities, but where it falls on the surface of lakes it floats for a while, then becomes water-logged and sinks to the bottom, where it would form a thin layer of inflammable material. If little or no muddy sediment were received into the lake, such an accumulation might go on from year to year until it had acquired a considerable thickness, and such light material as leaves of trees and needles of the fir would be liable to become interbedded with this deposit. Such a deposit, however, would not be uniformly pure, as every shower of rain would be sure to wash in a little sediment round the margin of the lake, and so render the pollen sheet clayey along such areas of sedimentation. Somewhat analogous to these pollen showers is the spore dust from tree-ferns, which is described by R. M. Johnston† as so filling the air at certain seasons in the fern-tree gullies of Tasmania, as to affect travellers with fits of sneezing while passing through such belts of spore-laden atmosphere.

Phenomena somewhat analogous to those of the pollen and spore showers would be likely to have obtained on a grander scale during the Permo-Carboniferous Period in Australia. Here and there around the margins of the low-lying swampy flats in which the coal was being found there would be likely to be shallow lakes devoid of vegetation, so that although the supposed

* Proc. Roy. Soc. Edinburgh, Vol. IV. p. 157 (1859). The author is indebted to Professor A. H. Green's Geology, Part I. p. 184 (1882) for this reference.

† Geology of Tasmania, by R. M. Johnston, F.L.S., &c., 1888, p. 138.

spore showers would fall with tolerable uniformity over the edges of the plains of the Greta coal-basin, only such portions of the showers as fell on the surface of the lakes would be fairly free from admixture with vegetation, and so would form, when they sank water-logged to the bottom, a tolerably pure inflammable deposit, with, of course, a certain amount of peaty material intermixed. Every one of the minute laminæ of the kerosene shale may therefore represent a spore shower, or a season of spore showers, so that it may have taken many hundreds of years to have admitted of the formation of a seam of kerosene shale five feet thick, as at Hartley. It is possible, however, that these laminæ may be simply due to superincumbent pressure, irrespective of individual spore showers, and they may therefore have no special chronological value. Subsequent to these supposed local accumulations of pure spore deposits in the shallow lakes of the Greta coalfield, there is evidence of sedimentation having set in again, which, before the close of the Permo-Carboniferous Period, buried the Greta coalfield in places under at least 6000 feet of strata. The great pressure and considerable heat consequent on the Greta coalfield being loaded with such a thickness of sediments would tend to efface the original sporaceous character of the lacustrine spore beds, especially in those areas where the deposit was so fine that the individual spores were in close contact with one another; but where they were much intermixed with muddy sediment, the isolation of the individual spores would prevent their being agglutinated, so that it is chiefly to these impure varieties of kerosene shale that observation may be most advantageously directed with a view to seek further information as to the origin of the purer varieties.

Possibly the minute spherical bodies observed by the author in association with kerosene shale may be the spore cases of *Rhizocarps* allied to *Salvinia* of the present day, and so abundant in the bituminous Huron Shales of Ohio.

The origin of the kerosene shale of New South Wales from seeds or spores is stated by Mr. Dixon, in his paper above quoted, to have been advanced before by some one, but up to the present

the author has not met with any reference to such a hypothesis. Mr. Dixon states, as an objection to the "Seed-and-spore-Theory," that kerosene shale is not of a resinous composition. If, however, the kerosene shale of New South Wales be analogous to the Tasmanite of the Mersey River Coal-field in Tasmania, which is of approximately the same geological age, it may be composed of sporangia or spores without being of resinous composition, as Mr. E. T. Newton, F.G.S., in describing the Tasmanite, or White Coal of Tasmania says* that the apparent resinous particles which microscopic examination proves to be sporangia, are in reality not resinous, as they are insoluble in alcohol, ether, or bisulphide of carbon. This objection is therefore partly if not wholly answered by the results of Mr. E. T. Newton's experiments.

If, therefore, kerosene shale is formed chiefly of sporangia, it has analogues in this Tasmanite, and in the well-known "Better-Bed" Coal Seam near Bradford, England, which latter, as described by Professor Huxley,† is chiefly made up of spore cases and spores.

Further light may be thrown upon the origin of kerosene shale by careful microscopic research, a means of study, which up to the present has never been systematically applied to the oil shales and coals of this colony.

The above theory is advanced by the author in a tentative manner, open to subsequent correction, and is chiefly based on his recent observation of the frequent association of abundant small spherical bodies like sporangia or seeds with the kerosene shales and cannel coals of this colony.

The author is indebted specially to Mr. John Waterhouse, M.A., of West Maitland, for kindly procuring him the specimens of sporangia (?) fireclay and cannel coal exhibited this evening, to Messrs. C. S. Wilkinson, R. Etheridge, Jun., and J. J. Fletcher, for many useful references and suggestions, and to Mr. P. T. Hammond of the Mines Department, for drawing the accompanying plate.

* Geol. Magazine, 1875, Dec. 11, Vol. II., p. 339.
† Critiques and Addresses, pp. 94-97, 1873.

Appendix.

Since reading the above paper, with the exception of one or two references which have been subsequently added, the author has succeeded in preparing a good microscopic section of the kerosene shale from Joadja Creek. Examined under the microscope by transmitted light, the small spherical resinous-like bodies, of which the shale is chiefly composed, are seen to possess a decided organic structure, which appears to resemble that of the minute "pin-head" bodies of the carbonaceous clay shales at Hill Top, near Mittagong, and at Woodford in the Blue Mountains, but differs somewhat from that of the objects figured in the accompanying plate. Numerous aggregations of minute spindle-shaped or club-shaped bodies are seen to occur in each globule, and recall the appearance of zoospores in some forms of Algæ. It is just possible, therefore, that hereafter it may be found that these spherical bodies are to be referred to some variety of fresh-water Alga, which, like the *Volvocineæ*, consist of single gelatinous globules enclosing zoospores. In this case the lenticular deposits of kerosene shale would have their analogues in the deposits of "vegetable turtle fat" already referred to, and to accumulations of infusorial earth, and perhaps to the sheets of Coorongite, if the latter be of cryptogamic origin. At all events, in the present state of our knowledge, it may be asserted that kerosene shale was probably formed in lakes, and that it was formed from minute plant bodies, probably either sporangia or algæ. Mr. R. Etheridge, junr., has kindly promised to assist the author in investigating this question, and the author hopes that Mr. Etheridge and he will soon be able to communicate to the Society a joint paper on this subject.

EXPLANATION OF PLATE.

The circular bodies are pseudomorphs in limonite after sporocarps (?), and occur in yellowish-brown fireclay associated with the Fireclay Seam, which overlies the Cannel Coal Seam at the Homeville Colliery, near West Maitland. These sporocarps (?) average about one-fortieth of an inch in diameter.

STUDIES IN AUSTRALIAN ENTOMOLOGY.

No. I.—REVIEW OF THE GENUS *SARTICUS* (CARABIDÆ).

By Thomas G. Sloane.

Sarticus.

Sarticus, Motschulsky, Bull. Mosc. 1865, pt. iv., p. 265.

This genus among the *Feronides* was founded in 1865 by M. Victor Motschulsky. The same year and previously to Motschulsky's paper, Baron de Chaudoir* and Count de Castelnau† described species belonging to *Sarticus* under the heading of *Steropus* (*Steropi australici*, Chaud.). In 1874, when reviewing de Castlenau's species,‡ de Chaudoir adopted Motschulsky's name *Sarticus* for his *Steropi australici.*

I find that Motschulsky's definition of *Sarticus* cannot be taken without modification; the following are its characters as I would define them.

Head rather small, the facial impressions faint.

Prothorax rounded on the sides; the basal angles rounded off; the lateral margins reflexed, more widely so towards the base; the median line impressed, ending behind in a punctiform impression; a single deep and wide impression on each side near the basal angles, touching the lateral margin at its posterior extremity; the marginal punctures at the base small and placed on the edge of the lateral margins; a narrow entire border along the anterior margin.

Elytra wider than the prothorax, usually convex, striate, with an abbreviated subscutellar stria between the suture and the first stria.

Abdomen with basal segment punctate.

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* Bull. Mosc. 1865, iii. p. 97.
† Trans. Roy. Soc. Victoria, VIII.
‡ Ann. Mus. Genov. 1874, VI.

Antennæ light, filiform; 3rd joint almost one-half longer than 4th, apical joint long, narrow, pointed.

Apterous.

Other features in common with other divisions of the *Feronides*.

Its position seems to be between *Cyphosoma*, Hope,* and *Notonomus*, Chaud. From *Cyphosoma* it may be readily distinguished by the presence of an abbreviated subscutellar stria, and by the segments of the abdomen not having a transverse line across them. It is more difficult to point out decidedly distinctive characters between *Sarticus* and *Notonomus*; the following seem the most noticeable: (a) the narrow border along the anterior margin of the prothorax, which is entire in *Sarticus*, does not reach the middle of the margin in *Notonomus*; (b) the posterior marginal punctures of the prothorax differ somewhat in their position—in *Sarticus* these are always placed on the *edge* of the margin, and a little more forward than in *Notonomus*; (c) the basal segment of the abdomen is always punctate in *Sarticus*, but not so in *Notonomus*.

The following is a tabular view of all the species of *Sarticus* I have seen; those unknown to me, viz., *S. iriditinctus*, Chaud., and *S. quadrisulcatus*, Chaud., I have omitted.†

I. Dorsal striæ of elytra not punctate.

Elytra convex... .... *S. aubei*, Casteln.

Elytra depressed........... *S. Macleayi*, sp.nov.

II. Dorsal striæ of elytra punctate.

A Mesosternal and metasternal episterna not punctate.

* The genus *Cyphosoma* was founded by Hope (Ann. and Mag. Nat. Hist. 1842, IX. p. 426) for an insect from Port Essington, which he named *Cyphosoma unicolor*. Chaudoir has determined (Bull. Mosc. 1878, LIII. pt. iii. p. 35) *Cyphosoma*, Hope, to be the same as *Cratogaster*, Blanch. Hope's name, which seems to have been lost sight of, must therefere be adopted.

† *Feronia lesueuri*, Casteln., Trans. Roy. Soc. Victoria, p. 210, is included in *Sarticus* in Masters' Catalogue, the authority being de Chaudoir (*Ann. Mus. Genov.* 1874, p. 596). It is unknown to me, but from de Chaudoir's description it is evidently not a *Sarticus*, nor do I think he intended that it should be placed in that genus.

a Elytra with humeral elevation.................... *S. saphyreomarginatus*, Casteln.

aa Elytra with no humeral elevation.

Elytra convex, with 7th stria obliterate........... *S. discopunctatus*, Chaud.

Elytra hardly convex, with 7th stria distinct *S. obesulus*, Chaud.

B Mesosternal and metasternal episterna punctate.

b Form and size normal.

c Elytra with interstices flat (striæ shallow and finely punctate).

Prothorax perceptibly narrowed behind........... *S. civilis*, Germ.

Prothorax not perceptibly narrowed behind......... *S. Rockhamptonensis*, Casteln.

cc Elytra with interstices convex (always convex in ♂, sometimes hardly so in ♀).

Elytra depressed, striæ deep and strongly punctate...................... *S. habitans*, sp.nov.

Elytra convex, striæ strong and finely punctate..... *S. monarensis*, sp.nov.

bb Form graceful, size small.

Elytra flat, broad, widely margined; prothorax transverse................ *S. cycloderus*, Chaud.

Elytra narrow, finely margined; prothorax almost as long as wide......... *S. ischnus*, Chaud.

Sarticus aubei.

Pterostichus aubei, Casteln., Trans. Roy. Soc. Victoria, VIII., p. 215; *Sarticus aubei*, Chaud., Ann. Mus. Genov. VI. p. 595.

In February 1888, I found a species of *Sarticus* at Bathurst after heavy rains; it seemed very common, great numbers being crushed on the pavements of the town by persons walking in the evening. I feel sure that this is *Sarticus aubei*, Casteln. De Castelnau's diagnosis of this species is quite useless, and as it has not been described before in an Australian publication, I append the following description.

Black, nitid; the striae not punctate. Prothorax transverse (4 mm. × 5 mm.), rounded on the sides and angles; lateral margins reflexed, more widely so at the posterior angles; median line lightly marked, not reaching either margin, ending behind in a deep foveolet; the disc crossed by faint transverse striolæ. Elytra oval (11 mm. × 6 mm.), rather convex, deeply striate; the sides abrupt, parallel, narrowing slightly towards the base; the lateral margins reflexed, sinuate towards the apex, rounded and joining the basal border at the shoulders; the striæ smooth; the dorsal interstices convex, equal, reaching to both base and apex, 3rd with three distinct punctures, 7th not elevated at the base, 8th and 9th flat, 8th wider than 9th; 7th stria shallow, punctulate, 8th shallow, its course interrupted by the large punctures of the 9th interstice, these wide apart in the middle but close and undulating towards the apex; abbreviated stria of moderate length. Segments of the abdomen with a foveiform impression on each side, these more transverse and punctate on the three last segments. Prosternum smooth without a margin. Metasternal episterna impunctate. Tarsi of hinder legs distinctly sulcated.

It probably has rather a wide range in eastern New South Wales.

Sarticus Macleayi, sp.nov.

Niger, nitidissimus; capite lævi; prothorace planiusculo, canaliculato, antice truncato, postice leviter emarginato, ad angulos posticos utrinque impresso, lateribus rotundatis marginatis; elytris

ovalibus, subplanatis, profunde striatis *(striis in fundo sub lente crenulatis)*; abdominis segmentis tribus ultimis utrinque foveolatis punctulatisque; episternis posticis haud punctulatis.

Long. 15, lat. 5 mm.

Very shining black. Head rather small, smooth; eyes prominent; post-clypeal suture distinct; clypeus with a well-marked punctiform impression on each side; the impressions on each side behind the clypeus short and shallow. Prothorax almost as long as wide ($3\frac{1}{2}$ mm. $\times$ 4 mm.), truncate in front, wider at the anterior angles than at the posterior, lightly rounded on the sides; the lateral margins narrowly reflexed in front, widely so at the posterior angles; median line lightly marked, not reaching either margin, ending in front in a faint transverse impression, and behind in a deep foveolet; disc closely covered with minute transverse striolæ. Elytra oval (8 mm. $\times$ 5 mm.), flat, deeply striate; sides abrupt, parallel, narrowing slightly towards the base; lateral margins rather wide, reflexed, rounded off and joining the basal border at the shoulders, sinuate towards the apex; the dorsal interstices equal, rather convex, extending in full depth to both base and apex, 3rd with three distinct punctures, 7th not elevated at the shoulders, 8th and 9th flat, and of about equal width; 7th stria shallow and finely punctulate; 8th shallow, interrupted by large punctures, these more widely placed in front, behind more closely set and elongate; abbreviated stria short, oblique. Three last segments of the abdomen with a broad shallow transverse impression on each side, these impressions punctate. Prosternum without a margin. Metasternal episterna impunctate.

This species is allied to *S. aubei*, but is altogether a flatter and smaller insect.

A single male specimen taken June, 1888.

Hab.—Coonabarabran, N.S.W.

SARTICUS SAPHYREOMARGINATUS.

Feronia (Steropus) saphyreomarginata, Casteln., Trans. Roy. Soc. Victoria, 1865, VIII. p. 222; *Feronia (Steropus) cyaneocincta*,

Chaud., Bull. Mosc. 1865, iii., p. 97; *Feronia (Pterostichus) azureomarginata*, Casteln., l.c. 1865, VIII. p. 215.

This species is easily distinguished from all others by the elevation of the 7th interstice of the elytra at the shoulders, and by the 6th stria bending in and joining the 5th near the base and just behind the humeral carina. These characters are peculiar to this species, and are in themselves sufficient to determine it. The striæ of the elytra are deep and strongly punctate; the prothorax and elytra have a bluish margin, the shades of blue being variable. The female is broader, and has the elytra duller than the male.

Length 16-20; breadth 6-8 mm.

A common and widely-spread species. I have it from Melbourne, Victoria; and from Mulwala, Condobolin, and the Warialda district in N. S. Wales. It also occurs in Queensland.

I am led to consider *Pterostichus azureomarginatus*, Casteln., as a synonym partly by de Chaudoir's remark * that "it is a *Sarticus*, and appears to me, apart from a little greater size, not to differ from *Fer. saphyreomarginata*;" and partly because I have a specimen from Condobolin, on the Lachlan, which agrees very well with de Castelnau's description.

SARTICUS DISCOPUNCTATUS.

Feronia (Steropus) discopunctata, Chaud., Bull. Mosc. 1865, iii. p. 97; *Feronia (Steropus) germari*, Casteln., Trans. Roy. Soc. Victoria, 1865, VIII. p. 222; *Feronia (Steropus) bonvouloiri*, Casteln., l.c. p. 223; *Sarticus ovicollis*, Motsch., Bull. Mosc. 1865, iv. p. 266.

A distinct species, and easily distinguished by its oval and convex elytra, with roughly punctate striæ; the 7th stria is obliterated (though usually perceptible); this gives the sides a smooth and glossy appearance; the lateral margins are broad and

* Ann. Mus. Civ. Genov. 1874, VI., p. 595.

distinct, and not sinuate towards the apex; the elytra are more broadly rounded behind than in other species.

Length 15-18; breadth 6½-8 mm.

Hab.—South Australia; Mulwala, N.S.W.

SARTICUS OBESULUS.

Feronia (*Steropus*) *obesula*, Chaud., Bull. Mosc. 1865, iii. p. 99; *Sarticus orbicollis*, Motsch., Bull. Mosc. 1865, iv. p. 266; *Feronia* (*Steropus*) *saphyripennis*, Casteln., Trans. Roy. Soc. Victoria, 1865, VIII. p. 223; *Feronia* (*Steropus*) *esmeraldipennis*, Castln. l.c.; *Feronia* (*Steropus*) *olivieri*, Castln., l.c.

The broad prothorax with rounded sides, and the wide and not very convex elytra are the conspicuous features of this species. The striæ of the elytra are deep and strongly punctate (more especially so in the male) on the anterior part of the elytra; towards the apex, and on the sides the striæ are shallower and the punctures fine. On the posterior part the elytra are flushed with purple, particularly towards the sides. Its affinity is to *S. civilis* from which it differs, *inter alia*, in its thorax being wider behind, and in its elytra having deeper and more strongly punctate striæ.

Length 15-17; breadth 5-6½ mm.

Hab.—Melbourne, Princetown (mouth of Gellibrand River), Victoria.

SARTICUS CIVILIS.

Pterostichus civilis, Germ., Linn. Ent. 1848, III. p. 167; *Feronia* (*Steropus*) *civilis*, Chaud., Bull. Mosc. 1865, iii. p. 99.

This species may be distinguished from *S. obesula*, which is nearly allied to it, by the absence of any bluish tint on the elytra, and by its more elongate shape; by the striæ of the elytra being shallower and much more finely punctate; and by the shape of the prothorax, which is not so transverse, and is narrower behind than in front; the lateral margins of the elytra are narrower and more sinuate behind. From *S. habitans*, another allied species, which a description might not differentiate much, though they are quite distinct, it differs, *inter alia*, in its prothorax being narrowed

behind, in the 8th interstice being broader than the 9th, and in the 8th stria not being thickly set with punctures.

Length 14-15 ; breadth 5 mm.

Hab.—South Australia.

I have only had the opportunity of examining three specimens of *S. civilis ;* of these two had the mesosternal espisterna distinctly punctate, while the metasternal espisterna in none of them presented more than two punctures; judging from the latter feature alone it would almost be better placed with group I. of my table.

Sarticus rockhamptonensis.

Feronia (*Steropus*) *rockhamptonensis*, Casteln., Trans. Roy. Soc. Victoria, 1865, VIII. p. 223.

This species has been united with *S. obesulus* by de Chaudoir,* but I have a female specimen from the Rockhampton district which appears to me distinct from *S. obesulus*, while it agrees with de Castelnau's description of *S. rockhamptonensis.*

In general appearance like *S. obesula*, but differing from it in having the prothorax less transverse; in the elytra of the female being duller, with the striæ shallow and very finely punctate, and with the interstices flat; in all the segments of the abdomen being closely and rather roughly punctate; and in the mesosternal and metasternal episterna being punctate.

Length 16; breadth 6 mm.

Hab.—Rockhampton district, Queensland, a single female specimen in my collection.

Sarticus habitans, sp.nov.

Niger, nitidus; prothorace antice posticeque truncato, canaliculato, ad angulos posticos utrinque impresso; lateribus rotundatis marginatis; elytris ovatis, tenue marginatis, fortiter striato-punctulatis, interstitiis convexis, 3° tribus punctis impresso, lateribus subparallelis; abdominis segmentis ad latera subtiliter punctulatis.

Long. 13-15 mm.; lat. $4\frac{1}{2}$-$5\frac{1}{2}$ mm.

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* Ann. Mus. Civ. Genov. VI. p. 595.

Black, nitid (elytra not opaque in the female). Head not offering any distinctive features. Prothorax rather broad and flat (3 mm. × 4 mm.); truncate in front and behind; the sides rounded; lateral margins wide at the posterior angles; median line distinct, not reaching either margin, ending behind in a punctiform impression. Elytra very little wider than the prothorax ($7\frac{1}{2}$ mm. × $4\frac{1}{2}$ mm.), sub-convex; the disc flatter in the male than in the female; the sides sub-parallel, with the lateral margins narrow and sinuate behind; striæ deep, thickly set with rather strong punctures, especially towards the sides (in the female shallower and less strongly punctate than in the male); 8th thickly and closely punctate, thus obscuring the punctures of the 9th interstice; interstices convex, equal in front, but the 2nd, 4th, and 6th narrowed towards the apex; 3rd with three impressed punctures, 8th not wider than 9th. Segments of the abdomen thickly and finely punctate towards the sides. Mesosternal and metasternal episterna punctate.

A common species in many parts of N. S. Wales. I have it from Mulwala, Goulburn, (at both places it is common) and Blayney. A single specimen which I have from Glen Innes, seems a lighter insect, with the prothorax more rounded, and the elytra more convex and less strongly punctate; it is possibly a distinct species though I am unable to regard it as more than a variety.

Sarticus monarensis, sp.nov.

Niger, nitidus, elytris obscure viridescentibus; capite parvulo, oculis vix prominulis; prothorace lævi, antice posticeque truncato, marginato, canaliculato, ad angulos posticos utrinque impresso, lateribus parum rotundatis; elytris ovalibus, subconvexis punctulato-striatis, interstitiis vix convexis 3° punctis tribus extus notato; abdominis segmentis ad latera subtilissime punctulatis.

Long. 12-13; lat. 4-5 mm.

Black, nitid, the elytra having a greenish tinge (in the female the elytra are more opaque than in the male). Head smooth, not

large; eyes not very prominent; clypeus lightly impressed on each side; the post-clypeal suture not distinct. Prothorax subquadrate (3 mm × 3¼ mm.), sides rounded; the lateral margins narrow in front, wider and upturned at the posterior angles; median line light, short, not reaching either margin, ending behind in a punctiform impression. Elytra oval (7 mm. × 4¼ mm.), rather convex, striate; the striæ thickly and finely punctate, extending in full depth to base and apex; the interstices equal, slightly convex in the male, but not so in the female, 3rd with three punctures placed almost in the 3rd stria, the punctures of the 9th placed along the 8th stria—more widely in front, closer, yet not confluent behind; abbreviated stria short and slightly oblique; the sides somewhat abrupt, with the lateral margins rather wide, narrowly reflexed, and rounded off at the shoulders to the basal border. Segments of the abdomen smooth, with very fine punctures—visible under a lens—towards the sides. Prosternum without a margin. Metasternal episterna strongly punctate.

This species has probably a wide distribution in the Australian Alps. There are specimens in the Australian Museum from Bombala and the Monaro district of N.S.W. The specimens on which the description above is founded are a pair in my collection from Porpunkah, near Mount Buffalo, Victoria.

Sarticus cycloderus.

Feronia (*Steropus*) *cyclodera*, Chaud., Bull. Mosc. 1865, iii. p. 100; *Feronia* (*Steropus*) *Waterhousei*, Casteln., Trans. Roy. Soc. Victoria, VIII. p. 224; *Feronia* (*Steropus*) *Mastersi*, Casteln., l.c.; *Feronia* (*Steropus*) *Blagravi*, Casteln., l.c.

Size small. Black, nitid, the elytra and under parts having a piceous tinge. Head small, lightly impressed on each side in front. Prothorax rather convex (2½ mm. × 3 mm.), rounded on the sides, a little narrowed behind, the margins wide behind; median line light, not terminating towards the base in the usual foveolet, but almost reaching the margin. Elytra oval (6 mm. ×

$3\frac{1}{2}$ mm.), a little wider than the prothorax, rather flat, the sides sloping gently from the 6th stria; striæ shallow, finely punctate, the abbreviated stria longer and less oblique than usual in the genus; interstices equal, not convex, 9th punctate as usual. Segments of the abdomen smooth. Metasternal episterna with a few fine punctures.

Long. 10, lat. $3\frac{1}{2}$ mm.

Hab.—South Australia.

I have six specimens, all of which I believe to be females; the anterior tarsi are as in the females of all other species of *Sarticus* I have seen, not being dilatate, but I cannot discern more than one setigerous puncture on each side of the anus in any of my specimens; in every other species I know the female has two anal punctures on each side.

The synonymy given above is on the authority of de Chaudoir.*

SARTICUS ISCHNUS.

Feronia (*Steropus*) *elegantula*, Casteln., Trans. Roy. Soc. Victoria, 1867, VIII. p. 224.

The name *Feronia* (*Sarticus*) *ischna* was proposed by de Chaudoir (Bull. Mosc. 1878, LIII. p. 68) for *Feronia* (*Steropus*) *elegantula*, Casteln., de Castelnau's name having been previously used in the genus *Feronia*.

This species is allied to *S. cycloderus*, Chaud., but is of much more elongate form, and has the prothorax hardly transverse. The following is de Castelnau's original description: "Length, 4 lines; very much like *Waterhousei* [*cycloderus*, Chaud.], but of a still more slender and elegant form; thorax much narrower behind; elytra more elongated and oval; three punctiform impressions on the interval between the second and third striæ."

To this I would add the following measurements taken from specimens in the Australian Museum, Sydney.

Length 8 mm.; breadth $2\frac{3}{4}$ mm. Prothorax, length 2 mm.; breadth $2\frac{1}{4}$ mm. Elytra, length 5 mm.; breadth $2\frac{3}{4}$ mm.

Hab.—King George's Sound.

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* Ann. Mus. Civ. Genov. VI. p. 595.

Sarticus iriditinctus.

Feronia (*Steropus*) *iriditincta*, Chaud., Bull. Mosc. 1865, iii. p. 100.

This species is unknown to me; the following is de Chaudoir's description.

"Præcedentis [*S. cycloderus*] summa affinitis, differre tamen videtur *thorace* longiore et angustiore lateribus minus rotundato, postice haud angustato, ovoideo, antice emarginato, basi subtruncato, margine posterius minus dilatato, elytrorum striis multo obsoletius punctatis, interstitio tertio punctis duobus tantum impressis, et imprimis colore totius fere corporis valde irideo.

Long. $8\frac{1}{2}$ mm.

Hab.—Swan River."

Sarticus quadrisulcatus.

Feronia (*Sarticus*) *quadrisulcata*, Chaud., Bull. Mosc. 1878, iii. p. 67.

A remarkable species unknown to me. The following are its chief characteristics taken from de Chaudoir's lengthy description.

It is distinguished from all the species of this subgenus, and from the majority of the species included in *Feronia*, with the exception of *Oribazus*, by the sculpture of the elytra which have only 4 deep sulci. Facies of *S. saphyreomarginatus*. Elytra not wider than the thorax, smooth and rather convex, striæ deep but narrower and less punctate [than in *S. saphyreomarginatus*], 2nd, 3rd, 6th, and 7th totally obliterated so that the interstice which separates the 2nd from the 4th has the width of 2 interstices, while there is only 1 between the 5th and 8th striæ. Of an iridescent black, very shiny, and as if varnished, prothorax and elytra of an iridescent bronze with the lateral channel of the prothorax, the wide external interstice of the elytra as well as the 9th interstice and the lateral groove of a coppery green, the lateral margins and the epipleuræ are black like the under surface.

Length 19 mm.; breadth $6\frac{1}{4}$ mm.

Hab.— Port Denison.

EXPERIMENTAL RESEARCHES WITH THE MICROBES OF CHICKEN-CHOLERA.

By Dr. Oscar Katz.

Introduction.

It will be remembered that Pasteur recommended, as a means for rabbit-extermination on a large scale, the disease commonly known under the name of *choléra des poules,* chicken- or fowl-cholera. The Royal Intercolonial Commission, appointed in April last year by the Australasian Governments to inquire into, and report upon, the schemes submitted for the extermination of rabbits in Australasia—a prize of £25,000 being offered for a successful remedy by the New South Wales Government—at once took the necessary steps to make itself acquainted with Pasteur's proposal. Being, however, dissatisfied with the information already to hand about the merits of this particular disease, or rather the microbes of this disease, as rabbit-exterminators, and considering the results of the experiments performed in France by Pasteur or under his direction, and of those by his delegates in Sydney, as unsatisfactory, it decided to have experiments of its own carried out.

As chief expert officer to the Commission, I was entrusted with this work. A laboratory—intended also for the investigation of any other scheme that might be worthy of consideration—was built on an hitherto unoccupied islet, called Rodd Island, in Iron Cove (Leichhardt Bay), a western portion of Port Jackson. The little island, of solid sandstone, and covered here and there with scrub, was well adapted for the object in view. Its plateau was mostly formed of loose sandy soil. The laboratory, a substantial building

of corrugated galvanised iron, the space between the sheets of the walls being filled up with sawdust in addition to a lining of felt, contained four rooms, and was fitted out with what appeared necessary. Gas was produced on the Island itself, out of gasolene, through a Müller's "Alpha Gas Making Machine," ordinary coal-gas across the water not being obtainable.* Water-pipes were laid on, the water supplied being rain-water collected in iron tanks. On one free side of the laboratory, under the verandah, arrangements were made for accommodating a large number of rabbits.

In the centre was erected a large enclosure, covered in all over with fly-proof wire-gauze in connection with wide-meshed wire-netting. This enclosure measured 100 feet (about 30½ mètres) in length, and 80 feet (24⅜ mètres) in width; it was slightly cut off at the corners. Most of the surface-area consisted of loose soil, in which artificial burrows could easily be dug (as will be seen later on); a small portion only being taken up by rocks (sandstone), which were partly on a level with the soil-surface, partly more or less projecting. There were a few small trees (gums, geebung) preserved in this enclosed place.

Adjoining one of the shorter sides of this main enclosure, was a large shed covered all round with corrugated iron, and having a brick-basement; at the rear of this shed was a number of pens and stalls.

In one corner of the Island, towards the water-edge, was an aviary, 15 feet (about 4½ mètres) square. One, the southern, half of it was covered at top and sides with sheets of galvanised iron; the other, northern half, only with wide-meshed netting and fly-proof wire-gauze. The greater portion of the aviary was accessible to the sun for nearly all day.

A dwelling-house, with belongings, completed the collection of buildings on Rodd Island.

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* See my communication "On 'Air-gas' for Bacteriological Work;" these Proceedings, Vol. IV. (2nd Ser.), p. 328.

The following pages contain an account of my researches with regard to the microbes of chicken-cholera. These researches, as far as they were carried out before April last, were made the subject of five Progress Reports laid before the Commission from time to time, and printed in the Volume of Proceedings of that Commission. I think that sufficient interest attaches to the subject to be dealt with in a scientific journal. For this purpose the whole available material, including that which was obtained since April last, has been worked up and grouped in an appropriate manner.

To Messrs. F. Dillon Bell and J. P. Meagher, who in succession were Assistants on Rodd Island, I am indebted for the services rendered by them in regard to the various experiments.

General Remarks.

The microbes with which all the experiments recorded in the following pages were carried out, were descended from those which were brought to Sydney from Paris by Pasteur's representatives. When, August 4th, 1888, the latter concluded their experiments of demonstration, which were begun about a month previously (July 7th), and to which attention has already been directed in the introduction (a special report on that demonstration may be found in the Volume of Proceedings of the Royal Commission), I took, with M. Loir's permission, some blood from the heart of a rabbit which had died after feeding on virulent broth-culture of the chicken-cholera microbes. Pure cultures were obtained from a "colony" on nutrient gelatine (after Esmarch's roll-method) from the blood of a rabbit, which had been inoculated with broth-culture in second generation, derived originally from the above-mentioned sample of blood.

In my experiments, partly such material was used as originated from that "colony," and was cultivated from tube to tube; partly cultures prepared directly from the heart-blood of rabbits newly dead from virulent "chicken-cholera," and not otherwise diseased. Such blood, as a rule, only contains the microbes under consideration.

As liquid medium for the cultivation of these microbes I employed rabbit-flesh infusion, in the following briefly termed rabbit-broth, or simply broth. Stated in a few words, this liquid was prepared by allowing finely minced flesh of well-nourished, thoroughly healthy, wild rabbits to stand with double the quantity (in weight) of distilled water, in a cool place, for twenty-four hours, stirring up from time to time, filtering and pressing through cheese-cloth, steaming, filtering again, neutralising with 20 p.c. watery solution of anhydrous carbonate of soda, or rather producing a slightly alkaline reaction, steaming and filtering again, and ultimately filling into different-sized, cotton-wool-plugged, sterilised test-tubes, which with their contents were thereupon discontinuously sterilised.

In such plain rabbit-broth, without any additional ingredients, the chicken-cholera bacteria grow very luxuriantly at a suitable temperature; they grow in that medium with pretty much the same vigour as in rabbit-broth to which 1 p.c. dry peptone and 0·5 p.c. sodium chloride are added. Broth of the latter description I employed, besides the former, in connection with certain experiments (*re* Immunisation, p. 526).

Of nutrient solid soils I mostly used a 6 p.c. rabbit-broth-peptone-gelatine, which was prepared in the usual way, with the difference that infusion of rabbit-flesh instead of beef-infusion was taken. On such a rabbit-broth-gelatine, the chicken-cholera microbes flourish excellently; fully developed stick-cultures always showed a substantial, expanded, superficial layer, of a whitish colour and sticky structure. The colour of the growth along the stick-canal, at first also whitish, changed into yellowish or yellowish-brown in old cultures; the same applied to isolated colonies in the gelatine.

In nutrient agar-agar—in the preparation of which beef-infusion was used—I saw the superficial growth (in stick-cultures) assume the shape of a thin film extending nearly over the whole surface, while the stick began to show by and by a darker coloration than the slightly yellow agar.

The usual nutrient gelatine (containing beef-infusion), as well as such gelatine with 2 p.c. grape sugar, or nutrient gelatine containing 2·7 p.c. sodium chloride, were occasionally taken into use.

In order to avoid repetitions, I will mention here that all the rabbits, upon which the microbes were tried from different points of view, were wild rabbits, if not specially noted to the contrary. These wild rabbits were ordered by the Rabbit Branch, Lands Department, Sydney, from near Hay, in New South Wales, about 420 miles from Sydney; they were mostly caught and sent to Rodd Island in a large number of consignments from Carrathool, near Hay. A few of the wild rabbits used came from Tasmania.

I ascertained the weight of six full-grown, perfectly healthy wild rabbits from Carrathool; the average weight was 1522 grammes (3 lbs. $5\frac{2}{3}$ oz.).*

EFFECT OF CHICKEN-CHOLERA MICROBES ON RABBITS.

It has been made known by Pasteur and others that rabbits manifest a great susceptibility towards the microbes of chicken-cholera, let the latter be applied as subcutaneous or cutaneous inoculation, through the alimentary canal, by way of injection into the peritoneal cavity, or of inhalation into the lungs. It has also been shown that the mucous surface of the uterus, after parturition, can form a means of entrance for the microbes, when

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* In the Paper the terms cubic centimètre, gramme, centimètre, millimètre, centigrade (°Cels.), are often used. I give their English equivalents as follows:—

One (1) cubic centimètre (ccm.) = sixteen (16) minims (drops in general).

28·3495 grammes (g.) = 1 ounce.

1·7718 ,, = 1 dram.

2·539977 centimètres (cm.) / 25·39977 millimètres (mm.) } = 1 inch.

n° Cels. (Centigr.) = 9/5 n + 32° Fahr.; [+20° C. = (9/5 × 20) + 32° F. = 68° F.]

other micro-organisms, highly pathogenic for rabbits, *e.g.*, anthrax bacilli, are powerless.*

Pasteur states that the action of chicken-cholera microbes is much more pronounced in the case of rabbits, than in that of fowls.† My observations in this direction—my material for experiments was derived from rabbits dead from "chicken-cholera"—are thus far in accordance with Pasteur's statement.

With regard to the effect of subcutaneous application of the microbes on rabbits, I can assert that the result which I obtained with *material of undoubted full virulence* (blood; artificial culture) on wild rabbits (also one tame one), *which had not been previously treated in any way*—I estimate the number of wild rabbits used in that way at about one hundred and fifty—was always a positive one. All of them succumbed to a disease which owed its origin to the chicken-cholera microbes. The time which it took from inoculation to death differed according to the degree of concentration of the virulent object introduced, and according to the individuality of the rabbits. Generally speaking, the microbes thus administered kill speedily. Instances hereof may be found in sufficient numbers later. The shortest time actually observed in a full-grown healthy specimen (♂), inoculated between the shoulder-blades with $\frac{1}{24}$ ccm. ($\frac{2}{3}$ minim) of heart-blood from a rabbit newly dead from "chicken-cholera," was about $8\frac{1}{2}$ hours; at another time, in the case of a half-grown rabbit inoculated at the belly with a small quantity of fresh broth-culture of the fourth generation, it was less than $7\frac{3}{4}$ hours. The longest space of time was observed in a full-grown, but apparently young doe, namely about forty-eight hours. This rabbit had been inoculated (at the belly) with $\frac{1}{40}$ ccm. of virulent rabbit-blood (see Table III., Rabbit No. 34; also p. 552).

* J. Straus et D. Sanchez-Toledo, "Recherches microbiologiques sur l'utérus après la parturition physiologique." *Annales de l'Institut Pasteur*, Tome II., No. 8, 1888, p 433.

† Sur la destruction des lapins en Australie et dans la Nouvelle-Zélande. *Annales de l'Institut Pasteur*, Tome II., No. 1, 1888, pp. 5-6.

My experience as to the effect which it has on fresh wild rabbits, when they are given to eat food contaminated with virulent chicken-cholera bacteria—this kind of treatment having naturally come largely and repeatedly into operation, as may be seen from the various experiments described in the following—may thus be summarised.

Small quantities of freshly prepared broth-cultures (1 ccm.-3 ccm.) of the microbes of chicken-cholera, or of blood derived from animals dead from the disease, added to food (green stuff, as cabbage- or barley-leaves; dry food, as bran) and consumed by fresh wild rabbits, caused the death of the animals with few exceptions. The time which, in this mode of infection, lay between feeding and death, fluctuated in the majority of instances between 18 and 25 hours; in others, more time elapsed until death followed; one full-grown robust rabbit, fed on bran with 1 ccm. of virulent broth-culture, held out for about 3½ days before it died (from "chicken-cholera").

On the other hand, it was now and then, but comparatively seldom, observed that fresh wild rabbits (also one tame one), which had partaken of food contaminated with as much as 1 ccm.-2 ccm. of fresh broth-culture, did not at all succumb subsequently, and if so, not to "chicken-cholera."

In about half the number of instances I am inclined to ascribe the reason for these failures to the circumstance that the respective rabbits, although having been somewhat starved before, waited for hours before eating of the food (green leaves), and that, in consequence, the infectious matter on it was exposed to the drying effects of a summer temperature, disastrous to the microbes. In this way, it may be urged, the virulence might have been lost altogether, or if a certain portion of active material was preserved, it was perhaps not sufficient to infect by way of the digestive organs.

Such an explanation, however, cannot be adduced in favour of four other cases (three wild rabbits fed on 1 ccm. of broth-culture; one tame rabbit fed on about 1½ ccm.); nor can it be maintained that in those cases the quality of the material employed was

to be blamed for the negative issue, because other rabbits treated under exactly the same conditions promptly perished. Be that as it may. That such rabbits as resisted in the first instance, were not, or had not become protected against the disease—except the tame rabbit mentioned, the history of which is given on pp. 522-525—was proved by their succumbing to it when they were in a satisfactory manner fed, in the second instance, on 2 ccm. of broth-culture, some time afterwards (one rabbit, however, died more than $2\frac{1}{2}$ days after the first feeding, from some indifferent cause, and another was lost sight of, before the ultimate proof of its susceptibility or otherwise could be given).

It has already been pointed out that the disease set up by the chicken-cholera microbes in rabbits, both by inoculation and feeding, mostly takes a rapid course. Although the term "chicken-cholera" for the disease caused by the microbes in rabbits, is inappropriate, I have made use of it for the sake of brevity and a better understanding.

The incubation occupies most of the time, the symptoms, or the actual disease being only of short duration. Death occurs under clonic cramps, and dyspnœa. Observations about the body-temperature during the disease, and some data regarding the breathing at the end of it, will be found in connection with experiments on the transmission of the disease from rabbit to rabbit (see pp. 554, 555, Table III.).

At the *post-mortem* examination one finds the following noticeable features :—The heart is filled with blood. The lungs are discoloured ; they are very voluminous owing to an emphysematic œdema involving their entire substance (on cutting through with a pair of forceps, or a scalpel, a crepitant sound is heard, and froth left on the blades of the instruments). Their surface presented a shining, mottled or tesselated appearance, due to ecchymoses or hæmorrhages in the lungs.

Pleura and peritoneum were mostly inflamed. The pleural, pericardial, and peritoneal cavities filled, as a rule, with serous exudations.

The spleen did not present any characteristic appearance.

The intestines were more or less hyperæmic, but of all the dozens of cases examined—rabbits fed as well as inoculated—I have only once met with a severe inflammation of the small intestine, the contents of which consisted of *blood-stained* liquid slimy masses. This was in the case of a vigorous, full-grown rabbit, fed at noon, February 19th, 1889, on cabbage-leaves and 2 ccm. of fresh broth-culture, and found dead at 7 a.m. next day.*

The rectum, or lowest portion of the large intestine, showed nearly always normal-looking fæcal masses, balled as usual; it was only rarely that its contents were not in the shape of isolated, well-formed "spheroids," but in that of soft, more or less coherent, greenish material.

Very frequently the rabbits, soon after death, had the nostrils covered with froth, which was stained with blood once. On the other hand, when the dead rabbits were kept for some time, in warm weather, undisturbed, in an open place, a blood-stained discharge from the nostrils was noticed repeatedly.

In conclusion, I may add that in the cases of inoculation, the seat of inoculation showed, as a rule, a slightly hæmorrhagic and gelatinous œdema. (One remarkable exception is that of a rabbit already mentioned above, as living two days after inoculation (see also p. 552); other noticeable exceptions are given by rabbits previously treated (see pp. 523-525, 529, 530).

The absence, as a rule, of hæmorrhagic exudations into the intestinal canal, and, as a standard, of diarrhœa proper, in rabbits treated with chicken-cholera bacteria, either by means of feeding or of inoculation, forms a fundamental difference from what we

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* Hæmorrhage of a different character took place in a pregnant doe, which formed one of two fresh rabbits placed in a wire-bottomed hutch with one which had been given $2\frac{1}{2}$ ccm. of virulent broth-culture (conf. p. 534). The doe, which was to all appearances in the end of the first, or the beginning of the second week of gestation, died from "chicken-cholera" by "contact," in less than 64 hours after being put in the hutch. Part of the fœtuses were found to have been aborted under *severe hæmorrhage.*

are accustomed to find in poultry affected with chicken-cholera. "Chicken-cholera" of rabbits has the character of a pure, most acute septicæmia, and is not a septicæmia in combination with "typhoid," as in poultry. In the judgment of the results obtained from certain experiments, we shall have to take this fact into consideration.†

History of Experiments on a Tame Rabbit.

1888.

(a) August 16th, 11.30 a.m.

A tame rabbit (♂, full-grown, long-haired albino, of the Angora type; not treated so far with "chicken-cholera" or anything similar) was *fed*, together with another tame, long-haired black rabbit (in one box), on cabbage-leaves infected with 3 ccm. of a virulent broth-culture of the chicken-cholera microbes. Both began to eat at once and had quickly finished eating the portion.

Results:

The black specimen was found dead (from "chicken-cholera") at 8.45 p.m., August 18th (again mentioned under "Experiments on Hares," p. 569).

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† I regret not to have had at my disposal active cultures of the microbes of Koch's rabbit-septicæmia. Dr. Fischer, of Sydney, handed me on the 7th July, 1888, Agar-Agar-cultures of these microbes, which he had brought from Koch's Laboratory when in Berlin some time before. On examination, however, they were found to have lost their vitality.

I should have liked to study such bacteria side by side with the bacteria of chicken-cholera. The difference, so far made out between the two, is one of degree rather than of kind.

In the blood of the rabbits (as well as in other animals which in my experiments died of chicken-cholera, see below) the bacteria, in properly stained cover-glass preparations, appeared in the shape of the well-known rods which showed only the ends deeply coloured, while a middle portion presented itself as a colourless spot, with delicate, coloured lines laterally.

In liver-blood of rabbits dead of "chicken-cholera," I repeatedly observed that among the large numbers of typical microbes, there occurred, here and there, rather anomalous forms, which had about the same outlines, and behaved towards methylene-blue in the same way as those typical forms, but which were very considerably larger. Their length was up to 0·004 mm. (cover-glass preparations), their width about a third of length.

The other white specimen was still alive, August 20th; meanwhile it behaved in quite a normal manner.

(b) August 20th, 9.30 a.m.

It was given cabbage-leaves with 3 ccm. of virulent broth-culture of the microbes of the third generation. It began to eat at once, and had soon finished.

Result :

It was still alive, August 25th, not showing any symptoms of illness all the time. Two control-rabbits (wild), of which one (full-grown) received the same quantity of virulent material as the tame one, namely 3 ccm., and the other (half-grown) only half as much, namely $1\frac{1}{2}$ ccm., were both found dead at 8 a.m., August 21st. *P.M.* in each case, *Positive.*

(c) August 25th, 10.30 a.m.

It was given $4\frac{1}{2}$ ccm. of an active broth-culture of the microbe of the third generation, along with cabbage-leaves. It was not slow in doing away with the portion of infected food given.

Result :

It remained unaffected by this treatment, whereas a vigorous wild Tasmanian rabbit, taken as control, was observed to die at 8.30 a.m., August 26th, or about 22 hours after feeding. The cause of death, "chicken-cholera."

(d) September 1st, 4 p.m.

It was *inoculated*, subcutaneously at the left side of the belly, with $\frac{1}{8}$ ccm. (2 minims) of a virulent broth-culture of the microbes, obtained directly from the blood of a rabbit which died after feeding with those microbes. It outlived this operation, whereas a control rabbit (wild) was found dead (from the disease) at 8 a.m., September 2nd. At the seat of inoculation, however, in the case of the tame rabbit, was formed a large abscess, at first closed, but beginning to open five days after inoculation, thereby discharging a sticky, yellowish, inodorous pus. (A platinum-loop full of the latter was *inoculated* into a wild rabbit, at 12.45 p.m., September 10th. This animal was found dead at 7.30 a.m., September 13th, having perished from causes independent of "chicken-cholera").

The abscess healed slowly; the healing process was completed in the beginning of October.

(e) October 10th, noon.

The rabbit received injected, on a corresponding spot on the right side of the belly, $\frac{1}{8}$ ccm. (2 minims) of fresh heart-blood from a rabbit out of those recorded in Table III., *Series X.*, No. 19). As control-animals may be taken, on the one hand, the two rabbits from *Series XI.*,

Table III., which died in 14h. 21m., and between 7h. 29m. and 9h. 29m., after inoculation, respectively, (quantity for inoculation only 1-40th ccm.); on the other hand, the fowl and pigeon from *Series III.*, Table IV., which died between 20h. 15m. and 21h. 40m., and between 14h. 15m. and 20h., after inoculation, respectively, (quantity for inoculation only 1-40th ccm.). The tame rabbit did not become seriously indisposed. It reacted again through the formation of an abscess at the point of injection, and a higher body-temperature for some time after the operation.

Remarks on Body Temperature, &c. :—

October 10th—At time of inoculation (noon)		...	40·4° C.
,, ,,	5.55 p.m.	...	41·0°
,, ,,	10.15 p.m.	...	41·2°
October 11th—	11 a.m.	...	40·47°
,, ,,	3.30 p.m.	...	40·2°
,, ,,	10.10 p.m.	...	40·86°

On the morning of this day this rabbit's appetite was not so keen as usual. The seat of inoculation inflamed.

October 12th—	at 3.15 p.m.	...	40·6°
October 13th—	1.15 p.m.	...	40·05°

October 18th—A distinct closed abscess, elastic to the touch, pink at surface, and of pear-shape.

October 19th—Abscess still closed, measuring 30 mm. in length (from apex to base), 23 mm. across the widest part, raised about 12 mm. above the level of the adjoining portions of the skin of the belly.

October 22nd—Abscess still closed, but apparently smaller.

October 26th—Abscess apparently discharging pus through a small hole. By pressing, pus of a thick, tenacious, and inodorous nature was obtained. The microscopical examination of samples of this pus (cover-glass preparations coloured with methylene-blue solution) did not disclose any chicken-cholera bacteria.

November—Traces of abscess disappearing.

1889.

(f) May 9th, 12.45 p.m.

The tame rabbit (which, I may mention here, was from the first to the last treatment, and afterwards, kept in a large enclosed place) was again treated, after an interval of *seven* months. This time I injected 1-24th ccm. (⅝ minim) of fresh heart-blood (from a rabbit dead of "chicken-cholera" after inoculation) under the skin at the back, between the shoulder-blades. Another vigorous wild rabbit was subjected to the same

treatment. The latter was found dead at 9.50 p.m., same day, it having died between 9 p.m. and that time (*i.e.*, between 8 and 9 hours after inoculation). (Result of *P.M.* examination, "chicken-cholera.")

The tame rabbit appeared somewhat indisposed on the evening of the same day, and on the morning of the following day. After that time it behaved as lively as usual, ready to eat any food given to it. But this time again an abscess developed itself at the place of inoculation, without having, however, any fatal effects on its bearer. The abscess discharging again copious quantities of pus, had almost completely healed up in the middle of June; on the other hand, under the skin to the left of the seat of the abscess, a hard, freely movable nodule of about nutmeg- shape and -size was noticed. When seen, June 29th, the wound had completely healed up and the nodule disappeared.

Other Experiments on Rabbits regarding Immunisation.

It is known that Pasteur succeeded in conferring immunity against infection by virulent chicken-cholera bacteria, on fowls which had previously been inoculated with liquids obtained by filtering virulent broth-cultures of those bacteria through a Pasteur-Chamberland filter. The bacteria being thus eliminated, the effect produced by the filtrate must be ascribed to soluble substances resulting from the growth of the bacteria in the culture-fluid.

The results of a few similar experiments on rabbits are published by Prof. P. Foà and Dr. A. Bonome, in Turin.* By repeated injections of filtered broth-cultures of the chicken-cholera microbes into a rabbit, and subsequently of active culture, the death of the animal from chicken-cholera occurred at a considerably later date than that of a control-rabbit. By injecting successively larger doses of filtrate, and more frequently, a rabbit was rendered altogether insusceptible to a subsequent inoculation with such active microbes as were able to kill a fresh rabbit after a certain time.

* Ueber Schutzimpfungen. *Zeitschrift für Hygiene*, Band V., Heft 3, 1889, p. 423.

In the following I record a number of experiments which were undertaken with a view to ascertaining, whether it was possible to protect rabbits from the effects of virulent chicken-cholera bacteria, by administering to them such liquids in which the virulent microbes had propagated, but were afterwards killed by moderate heat. A preliminary experiment had shown me that, by immersing ordinary thin-glassed test-tubes containing fresh broth-cultures of the microbes, in water kept at 60°C. (140°F.), samples of the contents derived after 15, 30, 45, 60 minutes, were proved to be completely sterile in each case. Such sterilised cultures I employed of two kinds. The one description of culture-liquid was plain rabbit-broth, of slightly alkaline reaction; the other rabbit-broth, to which had been added 1 p.c. peptone and 0·5 p.c. salt; reaction the same. The cultures to be sterilised were left in the water-bath of the above temperature for 30 minutes.

I selected ten full-grown, well-conditioned wild rabbits, having been kept on the Island among others, which served me for control-experiments, for about three months. They had so far not been experimented upon, except that they had for some time previously been in an enclosure separated, by means of a double fence of rabbit-netting with fully a yard of space between, from another portion of the same enclosure in which wild rabbits were allowed to die of "chicken-cholera," and the dead bodies not removed until some time afterwards. This was, as may be seen later on, for the sake of testing the value of the disease with regard to its possible spread from infected to healthy rabbits under certain conditions.

The ten rabbits were placed separately in clean, spacious, sheltered hutches. I first intended to administer the different quantities of sterilised cultures directly *per os;* on finding, however, (by trial on an indifferent rabbit) this procedure not safe enough, I gave them to the rabbits in a small portion of bran, of which they were very fond. Bran was also used in these experiments when virulent broth-cultures were fed. To induce the rabbits, the control-rabbits included, to eat the portions given to them at once,

they did no receive any food, except water, on the morning of the day when (soon after noon) they were to eat the specially prepared food (conf. Footnote, p. 533). The result was quite satisfactory.

In order to avoid repetitions, I will mention here that all the broth-cultures, both those to be sterilised and those to be used in their active state—in the latter case plain rabbit-broth only was the nourishing medium—had been obtained from fresh heart-blood of rabbits, inoculated for that purpose with virulent broth-culture of the microbes. Such blood was tranferred in small quantities by means of a platinum-loop into the culture-tubes which had been warmed before in the water-bath, so that the broth contained in them showed already a temperature of some thirty degrees Centigr. They were then placed in a thermostat, where they remained for about 24 hours at a temperature close on 37·7°C., roughly speaking, between 37·5°C. and 38°C. They were then used immediately afterwards.

The plan of feeding the ten rabbits on sterilised cultures was as follows :—Two of them were to receive three successively increased portions at certain intervals, the next two one more than the first, the third one more than the second, and so on.

Section I.

1889.

Two rabbits were fed *three* times on steadily increased quantities of sterilised culture in peptonised broth (for one) and plain broth (for the other), as follows :—2 ccm., April 16th ; 4 ccm., April 17th ; 6 ccm., April 19th.

On April 21st, at about 1 p.m., up to which time the two rabbits appeared perfectly normal, they, as well as a vigorous control-rabbit, were given each 1 ccm. of active broth-culture in some bran. The control-rabbit died between 6.30 a.m. and 7.45 a.m., April 23rd, of "chicken-cholera." One of the principal rabbits, namely that previously fed on sterilised peptonised broth-culture, was seen to die at about 7 a.m., April 24th, of typical "chicken-cholera," as the subsequent examination proved.

The other rabbit which had been treated previously with sterilised plain broth-culture, being still alive April 27th, was given on that day, 2 ccm. of active broth-culture.*

It was still lively May 4th, when it was again fed, at about 1 p.m., this time on 3 ccm. of virulent culture. While another fresh, very robust rabbit, fed on 2 ccm. only, succumbed at 3 p.m., May 5th, to the disease, the former survived.

On May 10th, at about 2 p.m., it received 4 ccm. of active broth-culture; the same quantity was given to a control-animal which, however, had not finished eating it until 4 p.m. same day. The latter died between 2.15 p.m. and 2.35 p.m., May 11th, of "chicken-cholera;" the principal rabbit survived.

On May 15th, at about 2 p.m., this rabbit, and a control-rabbit, were fed on 6 ccm. of virulent broth-culture. The latter perished of "chicken-cholera" at 12.40 p.m., May 16th, *i.e.*, about 22½ hours afterwards. Neither did the former withstand this time; it died at 10.50 p.m., May 16th, *i.e.*, about 33 hours afterwards. On *post-mortem* examination, the carcass was found to be very stiff as usual; typical bacteria in preparations of the blood; but, with the exception of a pleuritis and a slight emphysema of the right lung, the organs looked normal. (Weight of the rabbit, 1490 grammes).

Section II.

1889.

Two rabbits were fed *four* successive times on the following quantities of sterilised culture in peptonised broth and plain broth, respectively: 2 ccm., April 16th; 4 ccm., April 17th; 6 ccm., April 19th; 10 ccm., April 21st.

On April 23rd, at 1.15 p.m., they, as well as a control-rabbit, were given 1 ccm. of active broth-culture. The latter died at 2.30 p.m., April 24th, of "chicken-cholera;" of the two former, one previously treated with sterilised plain broth-culture died about a quarter of an hour later, also of "chicken-cholera."

The other rabbit being still alive April 30th—it never exhibited any suspicious symptoms—was fed again on that date, at 2 p.m., on 2 ccm. of virulent broth-culture. It was found dead at 6.30 a.m., May 2nd, whereas another fresh rabbit fed at the same time, along with others, on only 1 ccm. of the same culture, was found dead at about 7 a.m., May 1st. Both succumbed to typical "chicken-cholera."

* As will be seen further below, the two rabbits of *Section IV.* and a control-rabbit were fed, the same day, on 1 ccm. of the same culture for each rabbit. Although this control-rabbit survived this time, and only one of the former died of the disease 22 hours after being fed, the virulence of the employed culture cannot be doubted.

Section III.

1889.

Two rabbits were fed *five* successive times on sterilised cultures either in peptonised, or in plain broth, as follows: 2 ccm., April 16th; 4 ccm., April 17th; 6 ccm., April 19th; 10 ccm., April 21st; 15 ccm., April 23rd.

On April 25th, at 1.15 p.m., these two rabbits, as well as a control-rabbit, were given 1 ccm. each of virulent broth-culture. One of the two first mentioned, namely that previously fed on sterilised peptonised cultures, died between 1 p.m. and 2 p.m., April 26th; the control-rabbit succumbed considerably later, it being found dead at 6.40 a.m., 29th April, *i.e.*, roughly speaking, after 3½ days. The cause of death each time was typical "chicken-cholera."

The rabbit previously treated with sterilised plain broth-culture, being still alive on April 30th, was fed at about 2 p.m. that day, on 2 ccm. of active broth-culture. It survived again, without offering any sign of a change in its behaviour, while a control-rabbit, fed on 1 ccm. only, along with others on the same date (see *Section V.*, mentioned also in *Section II.*), was found dead (from "chicken-cholera") at about 7 a.m., May 1st.

On May 4th, at 1 p.m., the above rabbit was given 3 ccm. of active broth-culture. A very robust control-animal which received 2 ccm. of the same culture (as also did two other rabbits treated before), died at 3 p.m., May 5th, of typical "chicken-cholera." The principal rabbit remained alive and well.

On May 10th, at about 2 p.m., 4 ccm. of virulent broth-culture were given to it. It survived again without, apparently, the least inconvenience. A control-rabbit, as already mentioned in connection with the rabbit under *Section I.*, of the same date, succumbed about 24 hours afterwards.

On May 15th, at about 2 p.m., the rabbit received 6 ccm. of active broth-culture. It withstood also this time, without showing any abnormal symptoms. A control-rabbit, as already mentioned under *Section I.*, died about 22½ hours after feeding.

On May 21st, six days after the last feeding on 6 ccm. of culture, the rabbit was *inoculated* with a small quantity of heart-blood, derived from a rabbit which had perished about 6 hours since, of typical "chicken-cholera" consequent on inoculation with virulent broth-culture. The quantity, namely 1-48th ccm. (⅓ minim) was injected by means of a pointed glass-tube, under the skin at a spot on the belly. Another fresh rabbit, of the same sex (♂) and about the same size, served for control-inoculation. This control-rabbit died at 1.10 a.m., May 22nd, or 13 hours afterwards; the autopsy as well as the result of the microscopical examination of cover-glass preparations of blood, secured the diagnosis—"chicken-cholera."

The principal rabbit remained alive for good, but exhibited the following symptoms :—At the place of inoculation there was formed a rather large abscess which began to discharge pus for some time, and through which a necrotised portion of muscle and skin was eliminated, similar to the process which may be observed in fowls. The rabbit, which had always a good appetite, became somewhat thinner; when seen again on June 15th, it was as well-conditioned as before the experiment; the wound was then not quite healed up. When seen on June 29th, the healing was perfect.

Section IV.

1889.

Two rabbits were fed *six* successive times on sterilised cultures in peptonised broth or in plain broth, respectively, namely: the first five times exactly as under *Section III.*, and on the same dates; the sixth time on 22 ccm., April 25th.

On April 27th, at 1 p.m., each of them, and a control-rabbit, were given 1 ccm. of virulent broth-culture. The rabbit previously fed on sterilised peptonised cultures, died from typical "chicken-cholera" at 11 a.m., April 28th, that is 22 hours after feeding. The other rabbit, as well as the control-animal, did not succumb this time.

On May 4th, at about 1 p.m., both received 2 ccm. of active broth-culture each. A control-rabbit died at 3 p.m., May 5th (the same already mentioned under *Sections I.* and *III.*, May 4th); the rabbit previously treated with sterilised plain broth-cultures perished between 8.45 a.m. and 9.30 a.m., May 6th, that is about 44 hours after feeding, whereas the original control-rabbit was found dead at about 6.30 a.m., May 7th, it having died between 9 p.m., May 6th, and that time.

Section V.

1889.

Two rabbits were fed *seven* successive times, of which the first six were as in *Series IV.*, and the seventh time was on April 27th, when 45 ccm. of sterilised culture, either peptonised or plain, were given.

On April 30th, at 2 p.m., each of them, as well as a control-rabbit, received 1 ccm. of virulent culture. The last-mentioned rabbit was found dead at about 7 a.m., May 1st (as already notified under *Sections II.* and *III.*). The rabbit formerly treated with sterilised peptonised cultures died between 10 a.m. and 11.15 a.m., May 3rd, or somewhat less than 3 days after feeding; cause of death, typical "chicken-cholera." The other rabbit, treated with sterilised plain broth-culture, did not become affected.

On May 4th, at about 1 p.m., it was fed on 2 ccm. of active culture. It died at 4.30 p.m., May 5th. At the *post-mortem* examination everything

was found as in ordinary rabbits dead from the disease. A control-rabbit died $1\frac{1}{2}$ hours before, at 3 p.m., that day (as already mentioned under *Sections I., III.* and *IV.*).

According to the results thus obtained in the foregoing experiments, which are not numerous and not varied enough to admit of any definite conclusions to be drawn, the possibility of the protective power, on rabbits, of sterilised broth-cultures introduced successively into the digestive canal, against a subsequent infection by active cultures, can hardly be denied. We see that a subsequent feeding on 1ccm. of virulent culture had in several cases not the slightest effect on previously treated rabbits, while control-rabbits succumbed, with one exception (1 ccm.). Continued feedings up to 6 ccm. (two cases) of active material caused the death of all rabbits except one, out of *Section III.* This rabbit survived even inoculation, of which another fresh rabbit perished quickly.*

Cultures in peptonised rabbit-broth, and sterilised, proved themselves, against my expectation, inferior to such made in plain rabbit-broth, as regards their protective influence on rabbits.

Is "Chicken-cholera" a Contagious Disease among Rabbits?

The question as to whether, or to what degree, rabbits suffering or dead from "chicken-cholera," are able to communicate the fatal disease to other healthy rabbits with which they are associated, was one that engaged my attention for a considerable time.

Experiments by Pasteur and his Representatives.

Pasteur states that fresh rabbits placed with others which have partaken of food contaminated by virulent chicken-cholera microbes, die in large numbers.†

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* If possible, and unless the rabbit should die from some cause or other, I intend to try another inoculation several months after the first.

† Sur la destruction des lapins en Australie et dans la Nouvelle-Zélande *Annales de l'Institut Pasteur*, 2me année, 1888, p. 6.

Five tame rabbits, in one box, were fed on infected food, and 6 hours later three fresh ones (not contaminated) were introduced into the same box. Apart from the five former, one of the three latter succumbed to "chicken-cholera." *

In another experiment, four tame rabbits received microbe-contaminated food, and 7 hours later when all the food had disappeared since several hours, four new rabbits were penned up in the same box with the four first ones. The carcasses of these four infected rabbits, which died within 23 hours, were left in the box. All the four additional rabbits were dead from "chicken-cholera" within six days from the beginning of the experiment.†

An experiment on a large scale‡ made by Loir, at Pasteur's instigation, on Mme. Pommery's Estate, at Reims, on the rabbits in an enclosure of eight hectares (about twenty acres), resulted in killing off the whole number of rabbits there, which were estimated at more than a thousand. According to the evidence given before the Rabbit Commission in Sydney by Pasteur's representatives, it was considered as probable that the mortality among those rabbits was partly due to the transmission of the "chicken-cholera" virus from rabbit to rabbit. In my opinion, this wholesale mortality can satisfactorily be explained without taking to "contagion."

Lastly, I adduce the experiment of demonstration performed by Pasteur's delegates at Rodd Island (Sydney). *Five* wild rabbits, fed in one cage on cabbage-leaves sprinkled with 5 ccm. of a virulent broth-culture, were soon afterwards placed among *twenty* fresh rabbits (also wild) in a four-sided wooden enclosure of only one square metre area (about 3′ 3½″ square), in a stable-stall. The observation extended to a period of ten days. Within this period *eleven* rabbits in all died, among these, *three* (specially marked) of the *five* which had been given infected food, while *one* of the latter survived. The fate of the *fifth* of the originally infected rabbits could not be ascertained, because, inadvertently, it had not been marked. Accordingly, either *seven* or *eight* of the *twenty* uninfected rabbits died. All the dead rabbits were left in the enclosure until the demonstration was concluded, with the exception of *three not marked* ones which were removed during the experiment for examination (among these, *one* infected one might or might not have been, to judge from what has been stated above). In consequence of this examination, the diagnosis "chicken-cholera" could be given in each case. In order to fully decide whether the other *unmarked* rabbits (five) also perished of "chicken-cholera" or not, a *post-mortem* examination would have been necessary; this, however, was not made.

* loc. cit., pp. 4, 5.

† loc. cit., p. 5.

‡ loc. cit., pp. 7, 8.

Own Experiments.

In my official reports full details (with illustrations) are furnished about the experiments undertaken by me with a view to obtaining what information was considered by the Commission as worth having. Here it may suffice to give a *résumé* of their arrangements and their results.

Generally speaking, such experiments were conducted :—

A. On infected and uninfected rabbits mixed together

I. In wooden hutches, either with wooden bottoms or wire-netting bottoms.

II. In enclosures containing artificial burrows.

B. On intact rabbits placed

III. In boxes or hutches, in which rabbits had died from "chicken-cholera."

Ad I.

(a) On September 3rd, 1888, ten full-grown rabbits were fed,* in separate cages, on cabbage-leaves to which was added a small quantity of virulent broth-culture of the chicken-cholera microbes.† This quantity was 2½ ccm. each for eight of the ten, 1 ccm. each for the two remaining ones.‡ Soon afterwards, when all the food had disappeared except in one cage, where only about half was eaten, the *ten* rabbits were placed, in the proportion of one to two, with *twenty* uninfected rabbits, of which six were only half-grown, in *eight* hutches, as follows:—*six* hutches (measuring in the clear inside 23″ × 18″ × 18″ in

* Whenever, during the course of my experiments, rabbits were to be fed on "chicken-cholera"-contaminated food, I adopted the precaution of starving them to some slight extent beforehand, in order to induce them to eat the infected meal given to them more readily. In spite of this arrangement it sometimes happened that the one rabbit or another was slow in touching the food, or finishing it up. Wild rabbits, when suddenly penned up in hutches, are naturally very shy and suspicious at first.

† In order to be sure on this and all other occasions, when green leaves were used, that the infective material adhered firmly to the food, and that the danger of the broth becoming detached or perhaps lost, while the rabbits were eating, be avoided as much as possible, each portion was prepared on a soup-plate, where the culture, which was sprinkled out of a fine-pointed measured glass-tube, was placed between leaves or portions of such, and these repeatedly pressed down, and turned by aid of flat wooden sticks.

‡ The history of the culture employed is as follows:—Colony from virulent blood of a rabbit (fed on culture), 10/VIII. 1888=I. generation; stick-culture in 6 p.c. rabbit-broth-gelatine, 14/VIII.=II. generation; stick-culture, 18/VIII.=III. generation; rabbit-broth culture, 1/IX=IV. generation The latter, when used September 3rd, had been since in thermostat at 33-35° C. for two days.

depth, height and width, respectively; three were wooden-bottomed, three wire-netting bottomed, the latter resting on sandy soil) were stocked with *three* rabbits each; *two* hutches (3′ 3⅛″ square, 2′ high; one wooden-bottomed, the other wire-netting bottomed, placed as before §) were stocked with *six* rabbits each; here, as well as there, always in the number of one infected to two uninfected specimens. The experiment lasted *seven* days. *Eight* of the ten infected rabbits promptly died from "chicken-cholera," as proved by the *post-mortem* examination—they were removed from their hutches soon after death—and by control-rabbits. All these had been fed on 2½ ccm. of culture. Of the remaining two, however, which had received only 1 ccm. culture, one died (after more than 2½ days) from some indifferent cause, and the other survived this time, while a control-rabbit (1 ccm.) succumbed to the disease. Of the *twenty* originally uninfected rabbits, *four* contracted "chicken-cholera," and died in consequence, in the smaller hutches, namely—*two* in one with bottom of rabbit-netting; *one* each in a wooden-bottomed and wire-netting bottomed hutch. I need hardly say that these *four* rabbits, which perished in from about two days and a half to four days seven hours after the beginning of the experiment, had been together with rabbits which, after feeding on 2½ ccm. culture, quickly succumbed, as mentioned above.

I have also to record the death of *ten* other (including five half-grown) rabbits out of the original twenty, within the seven days, but I was unable to trace, as cause, "chicken-cholera."

(b) On September 10th, 1888, *two* rabbits were fed on green barley and virulent culture (derived directly from the blood of one of the rabbits dead from "chicken-cholera" by "contact," in one of the hutches of the preceding experiment). *One* of them received 1 ccm.; the *other*, which was the surviving one from the former experiment after feeding of 1 ccm., was given 2 ccm. this time. They were placed in two of the smaller hutches (see above), one having a bottom of wood, the other one of rabbit-proof netting (as before), with one full-grown and one half-grown rabbit for each. The *two infected* rabbits died speedily from "chicken-cholera" (they were removed from their hutches soon after death); of the *four uninfected* rabbits, the two half-grown and one full-grown died within the first three days; the result of *post-mortem* examination was each time negative as regards "chicken-cholera." The other full-grown specimen was still alive after seven days.

§ All the eight hutches were placed in the large wire-gauze enclosure on the Island. Six of them (the small-sized) were so placed as to prevent the sun completely from shining into them; the inside of the two larger ones was only to a slight extent accessible to the sun.

Notes on the *Temperature* (in the shade) taken during the course of the experiments. The temperatures are given in the centigrade scale.

September 3rd.	7 a.m. 7°	1.45 p.m. $16\frac{3}{4}^\circ$	6 p.m. $13\frac{3}{4}^\circ$	10.30 p.m. $10\frac{1}{3}^\circ$	September 11th.	7.15 a.m. $10\frac{3}{4}^\circ$	2 p.m. $12\frac{1}{2}^\circ$	5 p.m. $11\frac{3}{4}^\circ$	10.15 p.m. 12°
4th.	7.15 a.m. 10°	1.30 p.m. 18°	5 p.m. $14\frac{1}{2}^\circ$	9.30 p.m. $10\frac{1}{4}^\circ$	12th.	7.30 a.m. $9\frac{1}{2}^\circ$	1.45 p.m. $16\frac{1}{4}^\circ$	... ..	Midnight. $14\frac{1}{2}^\circ$
5th.	7 a.m. $7\frac{1}{4}^\circ$	1 p.m. 20°	5.30 p.m. 16°	10.15 p.m. $12\frac{1}{4}^\circ$	13th.	7.30 a.m. 9°	1 p.m. $21\frac{3}{4}^\circ$	5 p.m. $16\frac{3}{4}^\circ$	10 p.m. $12\frac{3}{4}^\circ$
6th.	7.15 a.m. $8\frac{3}{4}^\circ$	1.30 p.m. 24°	5.15 p.m. 18°	10.45 p.m. $14\frac{1}{4}^\circ$	14th.	7.30 a.m. $10\frac{3}{4}^\circ$	1.30 p.m. 21°	5 p.m. $16\frac{1}{2}^\circ$	10.30 p.m. $9\frac{3}{4}^\circ$
7th.	7.30 a.m. 12°	1.45 p.m. 15°	5 p.m. $14\frac{1}{4}^\circ$	10.20 p.m. 10°	15th.	7.30 a.m. $9\frac{3}{4}^\circ$	2 p.m. $19\frac{3}{4}^\circ$	5 p.m. $16\frac{3}{4}^\circ$	11 p.m. 13°
8th.	7.15 a.m. $8\frac{3}{4}^\circ$	2 p.m. 16°	5.30 p.m. $13\frac{3}{4}^\circ$	10 p.m. $9\frac{1}{2}^\circ$	16th.	8 a.m. $12\frac{1}{4}^\circ$	2 p.m. $21\frac{3}{4}^\circ$	5.30 p.m. 19°	10.30 p.m. $15\frac{1}{4}^\circ$
9th.	7.30 a.m. $9\frac{3}{4}^\circ$	1.30 p.m. $14\frac{1}{2}^\circ$	......	11 p.m. 9°	17th.	7.30 a.m. $16\frac{1}{4}^\circ$	1.30 p.m. $19\frac{1}{2}^\circ$	5 p.m. $17\frac{3}{4}^\circ$	......
10th.	7.15 a.m. 8°	1.45 p.m. $16\frac{1}{2}^\circ$	5.30 p.m. $14\frac{3}{4}^\circ$	10.45 p.m. $12\frac{1}{2}^\circ$					

During the above time (September 3rd-September 17th) it was generally calm and fine, only now and then it was damp or raining.

The result of these experiments is somewhat marred by the great mortality among the rabbits under observation, independent of "chicken-cholera." Nevertheless it shows that, similar to those obtained by Pasteur and his representatives, the possibility of a transmission of the disease from rabbit to rabbit, under conditions such as are described, is out of question.

Ad II.

(a) On August 28th, 1888, *eight* full-grown rabbits (also two others for immediate control) were fed on cabbage-leaves sprinkled with 2½ ccm. of active broth-culture * for each. They were thereupon placed with *sixteen* uninfected rabbits (among which five half-grown) in special enclosures containing an artificial burrow each. These artificial burrows were constructed in the loose sandy soil which covers the surface of the large wire-netting and wire-gauze enclosure, and fenced in, at some distance, by rabbit-netting. They consisted in winding and branching trenches, as nearly as possible five inches deep and four and a half inches wide, covered with boards and soil so that they could easily be uncovered and inspected. They were provided with one entrance.†

Three rabbits (one infected, two uninfected) were turned into each of three small burrow-enclosures containing about 13′ 6″, 16′, 16′ 6″ of burrow, respectively; into another, with about 58 running feet of burrow, *six* rabbits (two infected, four uninfected) were let go; the last enclosure, in which were about 70 running feet of burrow, was stocked with *nine* rabbits (three infected, six uninfected). Within twenty-five minutes all twenty-four rabbits had found their way inside the burrows in their respective enclosures.

The *eight* infected rabbits (as well as the two others also fed on the same quantity of contaminated food) promptly died from "chicken-cholera," *six* outside, *two* inside the burrows. Their carcasses were left untouched on the spot, where found, for three full days.

Of the *sixteen* uninfected rabbits which, unless they died before, were to be left in the enclosures for seven days from the beginning, *six* in all (namely four full-grown, and two half-grown) died within this time. But not in one instance could the cause from which they died be identified as "chicken-cholera."

* The history of this culture is as follows:—Colony from virulent blood of a rabbit fed on culture, 10/VIII. '88=I. generation; gelatine-stick-culture, 14/VIII.=II. generation; broth-culture, 23/VIII.=III. generation; broth-culture, 26/VIII.=IV. generation. The latter remained, before use, in a thermostat at 35-37° C. for two days.

† They were constructed after data given by Mr. A. N. Pearson, of Melbourne, a member of the Royal Commission.

NOTES on the *Temperature*, both in air (shaded) and at the bottom of a separate small burrow or trench, without entrance (not used by the rabbits), in the following table called underground. Also notes on the *Weather* during the course of the experiments.

DATE.		TEMPERATURE (CENTIGR.).				WEATHER.
August 28th.	air (shaded) underground			4 p.m. 19°	7.45 p.m. $17\frac{1}{4}^\circ$ 16°	Bright and calm all day.
29th.	air (shaded) underground	7 a.m. $13\frac{1}{4}^\circ$ $15\frac{1}{4}^\circ$	12.45 p.m. 16° $15\frac{1}{2}^\circ$	5 p.m. $15\frac{1}{4}^\circ$ $15\frac{3}{4}^\circ$	11.15 p.m. $14\frac{1}{2}^\circ$ $15\frac{1}{4}^\circ$	Morning dull; strong southerly wind all day; night calm.
30th.	air (shaded) underground	7 a.m. $13\frac{1}{2}^\circ$ $14\frac{3}{4}^\circ$	3 p.m. 18° $15\frac{1}{2}^\circ$	6 p.m. 16° $15\frac{1}{2}^\circ$	11 p.m. $15\frac{1}{2}^\circ$ 16°	Calm and fine all day.
31st.	air (shaded) underground	7 a.m. $13\frac{1}{2}^\circ$ $15\frac{1}{4}^\circ$	1.30 p.m. $24\frac{3}{4}^\circ$ $16\frac{1}{4}^\circ$	6 p.m. $20\frac{1}{2}^\circ$ $16\frac{1}{2}^\circ$	10.30 p.m. $18\frac{3}{4}^\circ$ $16\frac{1}{2}^\circ$	Calm and fine all day.
September 1st.	air (shaded) underground	7.15 a.m. 17° $15\frac{1}{2}^\circ$	1 p.m. 14° $16\frac{1}{4}^\circ$	5.15 p.m. $12\frac{3}{4}^\circ$ 16°	10 p.m. 12° $15\frac{3}{4}^\circ$	Morning dull, air damp, light showers; afternoon light rain; evening calm and fine.
2nd.	air (shaded) underground	8 a.m. $9\frac{3}{4}^\circ$ 14°	2.30 p.m. $14\frac{3}{4}^\circ$ $15\frac{3}{4}^\circ$	5.15 p.m. $12\frac{1}{4}^\circ$ $15\frac{1}{4}^\circ$	10 p.m. $8\frac{1}{2}^\circ$ $14\frac{3}{4}^\circ$	Bright and calm.
3rd.	air (shaded) underground	7 a.m. 7° 14°	1.45 p.m. $16\frac{3}{4}^\circ$ 15°	6 p.m. $13\frac{3}{4}^\circ$ 15°	10.30 p.m. $10\frac{1}{2}^\circ$ $14\frac{1}{2}^\circ$	Bright, with light southerly breeze blowing.
4th.	air (shaded) underground	7.15 a.m. 10° $14\frac{3}{4}^\circ$	1 p.m. 18° 15°			Calm; sky overcast; air damp.

(b) In this experiment the whole of the large enclosure, already referred to, was utilised. This enclosure, which measured 100 feet by 80 feet, contained artificial burrows, in all about 185 running feet.

On November 7th, 1888, *one hundred* rabbits, mostly full-grown and only a few half or not quite full-grown, were let loose in that enclosed place. The rabbits were, as the result later on showed, mostly in a poor condition. Shortly afterwards, *ten* rabbits which had been fed on cabbage-leaves sprinkled with 2 ccm. of active broth-culture for each rabbit, were placed with the former in the same enclosure. On November 14th, another batch of similarly infected rabbits, this time *six*, among which three Tasmanian ones, were introduced. Lastly, on November 22nd, a third batch of *six* infected rabbits,* also fed on 2 ccm. culture,† were let loose in the same enclosure. On November 29th the period of observation terminated.

Infected Rabbits.—Of the *twenty-two* infected rabbits thus turned loose among other uninfected ones, *twenty-one* succumbed, while the *twenty-second* survived. (It died, however, December 3rd, *P.M. negative.*) Of the *twenty-one, three* were removed from the enclosure shortly after they were found dead, and examined (one, each, of the first, second, and third batch). The result of the examination was in the first case *positive* (rabbit found dead inside burrow), in the second and third, *negative.* The other rabbits, *eighteen* in number, were not taken out of the enclosure until the conclusion of the experiment, November 29th. *Twelve* of these *eighteen* died outside, *six* inside the burrows.‡ The proof of those *eighteen* having died from "chicken-cholera" was furnished partly by control-experiments on other rabbits, partly by the appearance of the carcasses—which showed *rigor mortis* exceedingly well-marked, in contrast to other rabbits which perished from some indifferent causes (except, of course, any septicæmia similar in effect to chicken-cholera)—partly by the characteristic symptoms which some of the rabbits under consideration were observed to exhibit when dying, or some time before death. Lastly, the diagnosis was made sure by the positive results of the direct microscopical examination of cover-glass preparations of blood derived§

* The consignment of rabbits, of which these six formed part, had been received on the Island only the previous day.

† The cultures used in this experiment were derived directly from blood of rabbits dead from "chicken-cholera," and incubated at 39-40°C. for 24 hours before being used.

‡ The burrows, of course, were opened and examined from time to time.

§ This was done each time by means of a clean sterilised glass-tube, which had been drawn out in the flame into a fine end of some length. By pushing this fine end through a suitable spot at either the right or the left side of the thorax, from which spot the hair

from a certain number (eight) which were picked out at random each time, and of the full *post-mortem* examination of one which was found dead inside burrow at the conclusion of the experiment.

Uninfected Rabbits.—Of the *hundred* uninfected rabbits placed in the enclosure, November 7th, five died quickly up to the morning of November 8th, and were at once replaced by fresh ones. Thence to November 14th, when the second batch of six infected rabbits were let loose, not less than *fifty-two* had died.

From November 15th to November 22nd, when the third lot of *six* infected rabbits were let loose, *seventeen* had died.

From November 23rd to November 29th (conclusion of the experiment), *ten* had died.

Thus it will be seen that not less than *seventy-nine* out of the hundred died, partly inside, partly outside the burrows. One rabbit managed to escape, somehow or other, into the adjoining shed, about a week after the beginning of the experiment. It was used otherwise. So that not more than *twenty* of the *uninfected* rabbits were left over ultimately.

The carcasses of the *seventy-nine* rabbits did not in the least indicate that "chicken-cholera" was the cause of their death; nor did the symptoms which a number of rabbits were seen to show shortly before death, correspond with those characteristic in "chicken-cholera." The carcasses were all removed from the enclosure as soon as it was possible, and submitted to a careful examination. But not in one instance could the cause of death be diagnosed as "chicken-cholera." On the contrary, I had little doubt that the huge mortality encountered in this experiment among the hundred rabbits arose from the effects of the starvation which they had to undergo, to a certain extent, before they were sent to the Island from the then dry country round Hay, New South Wales. I should add that before and after the above experiment, a similar mortality was noticed among rabbits kept in stock, and that every attendance as regards feeding, sheltering, or the like, was given to the rabbits on the Island on all occasions.

(An appended table of temperatures and notes on weather prevailing during the term of the above experiment may be found at the end.)

had been removed previously, a sample of liver-substance was derived. The opening thus made into the body closed up again after the tube had been taken out, and in this way the body was not perceptibly disturbed.

(c) The foregoing experiment being unsatisfactory in its results, on account of the high mortality among the rabbits from causes other than "chicken-cholera," the Commission decided for another large experiment.

For this purpose, the main enclosure on the Island (see above) was divided into two nearly equal portions by means of a double fence of rabbit-netting, with a clear space of one yard (about 92 cm.) between. The one division, which may be called the disease-division, contained about 136 running feet of artificial burrow; these burrows were old ones, formerly used, but here and there altered. In the other division, henceforth called the control-division, there was a total of about 95 feet of artificial burrow; there were two of such burrows, one old one, somewhat changed, and another fresh made.

The arrangement was, to turn into each of these divisions *fifty* healthy rabbits, not fed on the chicken-cholera microbes; to add to the *fifty* in the disease-division *three* batches of *five* rabbits for each, which had been fed on fresh cabbage-leaves sprinkled with 2 ccm. of a virulent broth-culture of the microbe of chicken-cholera for each rabbit. The first batch was to be turned in at once, the second after a week, and the third after a fortnight; the experiment was to be completed after three weeks from the outset.

The experiment was begun on February 12th, 1889, and concluded March 5th, according to programme.

Although the whole enclosure had been used from November 7th to the 29th, 1888, for the carrying out of the experiment mentioned under (b), p. 538, I did not think it necessary to specially disinfect it, in view of the new experiment. From the end of November, after the former experiment, some twenty rabbits were left there till the 24th January, without anyone dying from "chicken-cholera." During the interval, sunshine and wind could act on, and must have proved disastrous to, any chicken-cholera microbes that might have been deposited there. Then again, one portion of the enclosure was, in the fresh experiment, reserved as control-division, stocked with a considerable number of rabbits; of these, I may just as well state beforehand, not a single one perished from "chicken-cholera."

The result of the experiment which was carried out as said above,* was as follows:—

* Throughout this experiment I employed broth-cultures which had been obtained directly from fresh heart-blood of rabbits, inoculated for that purpose with "chicken-cholera." The tubes containing the microbe-infected broth were placed in a thermostat kept at about 38° C., where they remained for about 24 hours before being used. A temperature of that degree appears to answer for the growth of the microbes better than any other.

Disease-Division.

The *fifteen* rabbits (all full-grown, well-conditioned specimens) which after being fed on 2 ccm. of virulent broth-culture for each, on cabbage-leaves, were let go in the disease-division—*five* on February 12th, *five* on February 19th, *five* on February 26th,—died promptly without exception; the majority of them must have died in less than 20 hours. *Nine* of the *fifteen* died outside, *five* inside the burrows,* and *one* half outside and half inside. Among the nine first mentioned is included one, which lay dead in a hollow covered over by a stone, and which was easily accessible.

With one exception, the carcasses of the rabbits remained on the spot where they were found lying, until the end of the experiment, without any microscopical examination of their blood being made. The exception referred to is a rabbit which, forming one of the last batch of five rabbits placed in the division, February 26th, was found dead the following day, outside burrows. It was, on examination, found to be much bruised on the left side of chest and belly, an occurrence which must have accelerated its death, as putrefaction of the organs had already set in when the examination took place, soon after the rabbit was found dead. However, the heart-blood clearly showed the presence of numerous bacteria of "chicken-cholera." An unusually vigorous buck, inoculated with a small quantity of such blood, succumbed to "chicken-cholera" somewhat less than twelve hours afterwards. On the following morning, the intact carcass of one of the control-rabbits (see below) which had died the previous evening, was put in the place of the one removed from the enclosure.

The *fifteen* rabbits lying scattered in the disease-division undoubtedly perished from "chicken-cholera." On the one hand, *fourteen* control-rabbits, which speedily died without a single exception, died from "chicken-cholera," as unmistakably shown by the results of careful examinations. On the other hand, the appearance of the carcasses, and the symptoms which some of the rabbits were observed to exhibit when dying, corresponded with what occurs in "chicken-cholera" rabbits.

Of the *fifty uninfected* (*i.e.*, intact) rabbits, let loose in the disease-division at the beginning of the experiment, *four* died from "chicken-

* The burrows were, of course, opened from time to time; in all nine times.

cholera," all inside burrows, whereas *thirty-two* perished from causes which had nothing in common with that disease.*

The way in which these thirty-six rabbits, which died out of the fifty, were examined, in order to see whether chicken-cholera bacteria had found their way into them or not, was not the same each time.

Twenty-two were at once subjected to a full examination ; for that purpose they were taken out of the enclosure soon after their death. Besides noting the condition of the organs, a microscopical examination of blood was made. In sixteen cases liver-blood, in two cases liver- and heart-blood, in two cases heart-blood only was examined; in the latter two instances the liver being unsuitable. From two rabbits found dead inside a burrow, February 28th, and being in an advanced state of decomposition, a sample each of coagulated heart-blood was inoculated into a medium-sized rabbit. Of the twenty-two rabbits thus examined, only *one* (found inside burrow, February 16th) was proved to have taken "chicken-cholera," while in the others neither the autopsy, nor the microscopical examination of blood, warranted the same verdict.

From the remaining fourteen dead rabbits, while they were lying about, some liver-substance was taken (in the manner described previously), of which cover-glass preparations were made for microscopical examination. *Three* times a *positive* result was obtained, inasmuch as the typical bacteria of chicken-cholera, and only these, were present in large numbers. The three respective rabbits, which also by their outward appearance indicated death from "chicken-cholera," were left, where they died, until the close of the experiment. A subsequent *post-mortem* examination (including microscopic examination of blood, seven times) of the eleven remaining rabbits, in samples of liver of which the microbes of chicken-cholera had not been found, confirmed the negative result arrived at previously.

To return once more to the *four* originally *uninfected* rabbits which subsequently succumbed to "chicken-cholera," I am confident that the germs of this disease could not have been supplied to those four but by intentionally infected rabbits placed in the disease-division. Not only was the greatest care taken in eliminating any possibility of carrying infectious material among the rabbits, through food or

* Of these thirty-two died :—within the first week (12th-19th February), four ; within the second (up to the 26th February), nineteen, of which six found dead on one day (February 23rd), and nine on another (February 25th); within the third (last) week (up to 5th March), nine.

through the necessary inspections, but also, as stated, a control-experiment on fifty rabbits in an adjacent enclosure was made, with the result that not a single death from "chicken-cholera" occurred there.

Two of these *four* rabbits were found dead (inside burrows; carcasses still well preserved) on the 16th February (*i.e.*, somewhat less than four days after the first batch of five infected rabbits was turned loose); the third was found dead (inside burrow; carcass still fresh) two days afterwards, on the 18th; the fourth (inside burrow; carcass still pretty fresh) on the 23rd (*i.e.*, somewhat less than four days after the second lot of five infected rabbits was let loose). The probability, therefore, is that all *four* rabbits became infected *after* the death of specially infected rabbits placed with them. The answer to the question, in what particular way this infection took place, is open to conjecture. Considering that the evacuations of normal rabbits, dead of "chicken-cholera" after either feeding or inoculation, do not, as a rule, exhibit anything abnormal in their appearance; considering, also, that within the short time which it took, in the case of the fifteen rabbits, from the time of infection until death, fæces originating from the infected meals could hardly have been excreted; and lastly, in view of the negative results of a few direct experiments made by me (see pp. 546-548), it is far from being proved that the excrements (or the urine) of the rabbits which died in the disease-division from "chicken-cholera" were or must have been the vehicles of infection. On the other hand, it was frequently noticed that from the nostrils of carcasses of infected rabbits lying undisturbed, several days after the death of the animals, a blood-stained liquid exuded. Here and there it was noticed that the maggots of a small fly, and the latter itself, also ants, were at work about the carcasses. All that may have yielded the means for transmitting the virus.

Control-Division.

The number of fifty intact rabbits to be placed in this division at the beginning of the experiment, was at that date short of twelve; two died in the enclosure a few hours after being put there. When, two days afterwards, a fresh supply of rabbits came to hand, fourteen of them were turned in, in order to make up for the number missing.

At the conclusion of the experiment only *twenty-one* live rabbits were left over, twenty-nine having died, partly inside, partly outside the

burrows,* during the time. In every instance it was proved that death was not owing to "chicken-cholera."

This unfortunate mortality in both the one and the other division, from causes different from "chicken-cholera," was, in my opinion, favoured to a large extent by the extremely oppressive atmosphere and the excessive heat experienced now and then during the course of the experiment.† In the appended Table II. may be seen records of temperature and general remarks on the weather for that period. In quite a number of rabbits the liver and the intestines were diseased, such an appearance resembling that noticed in wild rabbits which were partly starved, or were feeding on unsuitable food. In other rabbits, again, the lungs were pneumonic. So that, after all, it is to be regretted that in this second large experiment, the rabbits used were not all of them in a healthy condition either.

Ad III.

In five single experiments fresh rabbits were placed in boxes or hutches in which rabbits had died from "chicken-cholera"; these rabbits, however, were removed shortly after being found dead. The result was in each instance a negative one, inasmuch as a transmission of the disease, in those cases, was not observed.

1888.

(a) August 29th, 9.30 a.m.

A rabbit was placed in a box, ‡ in which two rabbits, *inoculated* with a portion of virulent broth-culture, were found dead, one at 7.45 p.m., August 28th, the other at 7 a.m., August 29th. In the box there

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* The burrows in the control-division were always opened on the same days, on which those in the disease-division were examined.

† Most of them (twenty-three) died within eleven days from the beginning of the experiment; of these, six were dead on one day (Feb. 14th), and nine on another day (Feb. 23rd).

‡ The boxes or hutches alluded to in these experiments, were placed in the large enclosure on the Island in such a way that their insides were almost completely sheltered from the rays of the sun. For temperatures and weather during the experiments noted here, see p. 537.

was a considerable quantity of normal-looking fæces, and a large portion of the food given to the two inoculated rabbits on the evening of August 28th.

Result:

The rabbit was still alive, September 6th, when it was removed from its box.

(b) August 29th, 9.30 a.m.

A half-grown rabbit was placed in a hutch in which a rabbit, *fed* the day before on cabbage-leaves with 2½ ccm. of virulent broth-culture, was found dead (from "chicken-cholera") at 7 a.m., August 29th. The hutch contained a small quantity of normal-looking fæces; part of the bottom was damp with urine. The portion of food left over from feeding after the infected food had disappeared, was removed from the hutch.

Result:

The rabbit was found dead at 7 a.m., September 3rd. *P.M.*, *Negative.*

(c) August 30th, 10.15 a.m.

A half-grown rabbit was placed in a hutch, in which a rabbit fed, August 28th, upon cabbage-leaves with 2½ ccm. of virulent broth-culture, was found dead (from "chicken-cholera") at 9 p.m., August 29th. In the hutch there was a considerable quantity of normal-looking droppings; part of the bottom was damp with urine. The rabbit which occupied the hutch before, had eaten up all the infected food given to it, August 28th; but some of other (uninfected) food given later on, was still in the hutch, and not touched when the fresh rabbit was placed in it.

Result:

The rabbit was found dead at 7.15 a.m., September 6th. *P.M.*, *Negative.*

(d) September 4th, 2.50 p.m.

A rabbit, not quite full-grown, was placed in a hutch in which a rabbit, fed the day before on cabbage-leaves with 1 ccm. of virulent broth-culture, was found dead (from "chicken-cholera") at 2.40 p.m., September 4th. With regard to amount and appearance of excrement and food in the hutch, about the same state was noticed as in the foregoing experiment.

Result:

The rabbit was found dead at 9.15 a.m., September 9th. *P.M.*, *Negative.*

(e) September 4th, 2.50 p.m.

A young rabbit was placed in a hutch in which a rabbit, fed the day before upon cabbage-leaves with 2½ ccm. of virulent broth-culture, was found dead (from "chicken-cholera") at 2.40 p.m., September 4th. Amount and appearance of evacuations and food in the hutch, as before.

Result :

The rabbit was found dead at 9.15 a.m., September 9th. *P.M.*, *Negative.*

Some direct experiments were made with fæcal matter, or contents of the cæcum (the first and most voluminous portion of the large intestines) from rabbits which succumbed to typical "chicken-cholera" consequent on feeding. They showed that such material (in rectum and in cæcum) contained enough active bacteria to cause rabbits to perish from undoubted "chicken-cholera" when they were *inoculated* with small portions of that material. On the other hand, feeding on considerably larger quantities along with green stuff proved altogether inefficacious. The experiments may be described as follows :—

1888.

(1) Contents of lowest portion of rectum of a rabbit which, having died from "chicken-cholera" (feeding on virulent material) in one of the burrows (mentioned), was not removed therefrom after about four days. As an exception, the rectum contained very soft coherent green fæces. These were derived for examination by means of a sterilised, blunt glass-tube carefully introduced into the anus.

(a) *Inoculation.*

September 2nd, 11.35 a.m.

A rabbit was inoculated, subcutaneously at the belly, with a medium-sized platinum-loop full of such material. It was observed to die at 10.50 a.m., September 3rd, *i.e.*, 23¼ hours afterwards. The symptoms of the animal when dying, and the subsequent autopsy, together with microscopical examination of the blood, clearly proved the diagnosis—"chicken-cholera."

(b) *Feeding.*

September 3rd, 8.15 p.m.

A half-grown rabbit which had not been fed since 9 a.m. of the same day, was given a few cabbage-leaves smeared over with nearly

1 gramme of the fæcal matter, kept moist since the preceding day under a bell-jar. The rabbit, when seen at 10 p.m., had eaten all the food. It, however, did not show anything abnormal afterwards. It remained intact from this treatment.

(2) Contents of cæcum from a young rabbit, dead from "chicken-cholera" (feeding on virulent material). The cæcum was laid open at one spot by means of a hot scalpel, and the matter cautiously collected in a sterile test-tube.

October 15th, about 11 a.m.

Two half-grown rabbits which had not received any food in the morning, were given, together in one hutch, cabbage-leaves to which were attached 5 ccm. of a mixture consisting half of the above material and half of a 0·6 per cent. sterile salt-solution. They had eaten all but a few small pieces of leaves at 12.30 p.m., and had quite finished eating when seen at 2 p.m.

Results :

One was observed to be dying at 8.10 p.m., October 16th. As it was paralysed and evidently in pain, it was then killed.

The other was found dead at 9.15 p.m., October 18th.

In both instances the *post-mortem* examination yielded a negative result with regard to "chicken-cholera."

(3) Contents of cæcum from a robust full-grown rabbit shortly after its death from "chicken-cholera" (feeding on virulent microbes). Material derived as before.

1889.

(a) *Inoculation.*

May 6th.—One full-grown healthy rabbit inoculated (as before) at 4.45 p.m. with a medium-sized platinum-loop full of such material from cæcum. It died at 7.25 p.m., May 7th, under characteristic symptoms. The subsequent *post-mortem* examination secured the diagnosis—"chicken-cholera."

(b) *Feeding.*

May 6th.—One full-grown healthy rabbit was given, shortly after the above time, some bran with which were mixed 2 grammes of the matter of the cæcum-contents, diluted with some 0·6 per cent. sterile salt-solution.

The rabbit, being still lively on May 20th, was taken from its hutch and turned loose in an enclosure with others. According to

the caretaker on Rodd Island, it was found dead there, June 6th. It had been burnt when I visited the Island. His description of the condition of the carcass did not lend any support to its having succumbed to "chicken-cholera."

Besides, the result of another experiment showed that urine, taken from a rabbit newly dead in consequence of inoculation with virulent culture, had no effect on fresh rabbits which were inoculated with it.

1888.

September 11th, 1.30 p.m.

Two rabbits received subcutaneously about $\frac{1}{8}$ ccm. (2 minims) of such urine. The bladder of the rabbit from which the latter was obtained was much distended. The deep amber-yellow urine, which contained much firm matter (urates), was derived by means of sucking a small portion into a sterile glass-tube, through a little hole made by a hot glass rod into the lifted and stretched vertex of the bladder.

Results :

One rabbit was found dead at 7.30 a.m., September 13th. *P.M.*, *Negative.*

The *other* remained alive.

Transmission of the Virus of Chicken-cholera through Rabbits in Successive Generations.

It being from a theoretical as well as from a practical point of view—in case the microbes of chicken-cholera were to be employed as a means for the destruction of rabbits in Australasia—a matter of some importance to know whether these microbes, by passing through the bodies of rabbits in a number of continuous generations, become altered in their degree of virulence or not, it was decided that such an experiment, with a view to obtaining the required information, should be made, extending to the number of twenty successive transmissions from rabbit to rabbit.

Let us suppose the virus under consideration is endowed with the faculty of becoming more virulent, or, in other words, of

attaining a greater poisoning strength in its action on rabbits, by means of such successive transmissions, the consequence will naturally be that, under the same conditions, the period of incubation and actual disease, or the whole period from infection to death, becomes shorter, until a certain stationary point is reached; this period must, on the other hand, provided the conditions be the same, become longer, or infection with subsequent death may not follow at all, if there should be any decrease or attenuation of the virulence of the microbe. Should the latter preserve its degree of virulence uniformly from the first rabbit to the last, it stands to reason that the above period will remain about the same throughout, provided again the conditions be the same.

The experiment was carried out in the following manner:—A healthy pigeon was inoculated, October 3rd, with a small quantity of the surface-growth of a virulent stick-culture of the microbe of chicken-cholera (fourth generation, 32 days old). Not long after the death of this pigeon, which died of typical chicken-cholera within about twenty hours, two rabbits were inoculated, each with five platinum-loops full, equal to $\frac{1}{40}$ ccm., of heart-blood from this pigeon. The blood of the *first* rabbit that died, or that was found dead, furnished the material for inoculation, in like manner, into two further rabbits; with the blood again of the *first* of these dead, two other rabbits were inoculated, and so on till the number of forty rabbits, or twenty generations, were arrived at, when the experiment was concluded.

Before directing attention to the table of results of the experiments given below (Table III., at the end), I wish to state the following:—The rabbits used were, if not specially noted to the contrary, full-grown animals of normal appearance. If at the *post-mortem* examinations anything abnormal was found, it will be remarked in that table. The rabbits for this experiment were taken irrespectively of the sex. From practical reasons it was not possible to employ either males or females from the beginning to the end.

Immediately after the inoculations, the rabbits were placed in spacious clean hutches, separately, and food was given to them as usual. They were also, all of them, sheltered from rain and sun in like manner.

The blood used for the inoculations was in each case derived from the right *atrium* of the heart, near the *venæ cavæ.* The quantity of blood derived was pretty uniformly the same each time, viz., $\frac{1}{40}$ ccm. (*vide* above).

The time of inoculation of each new series lay within about *two* hours from the moment the first of the preceding series died. In cases where such rabbits were found dead, instead of being observed to die, the body-temperature then taken yielded a cue as to the approximate time when death occurred.

The seat of inoculation was always a corresponding area on the left side of the belly. After having shorn this area, a small fold of the skin, where there was no blood-vessel running, was cut across by means of a small pair of scissors. The wound thus produced was made the entrance into a small subcutaneous pouch, where the inoculation-material was easily and safely deposited by means of the platinum-loop.

The quantity of bacteria thus inoculated into the different rabbits was, comparatively speaking, a limited one. The direct microscopical examination of uniformly obtained and stained samples of heart-blood of all the rabbits shortly after their death, succeeded in showing only moderate numbers of individual bacteria.

In four cases I have tried to determine approximately the number administered, namely, in Inoculation Series X., XV., XIX., and XX., Nos. 19, 29, 37, and 39, Table III. About 10 ccm. of 6 per cent. rabbit-broth-peptone-gelatine in a test-tube were liquefied, so as to have a temperature of between 30° and 40° C., mixed with *one* platinum-loop full (one-fifth of the quantity for inoculation) of the heart-blood, and made to solidify, by means of iced water, in a homogeneous layer along the inner walls of the test-tubes (Esmarch's method). After having been in a thermostat at a suitable temperature for three or four days, the coating of gelatine in the tubes presented innumer-

able, as it seemed, whitish points of growth, or colonies, the number of which, however, could without difficulty be calculated by counting the number of colonies at, usually, ten different spots each of the area of one-sixteenth of a square cm. area, cut out of a piece of black paper. The total number of colonies which were calculated as being contained in the four tubes, amounted to 67623, 71887, 65367, 48593, *i.e.*, in the mean, 63368. This figure multiplied by five yields 316840, and, if we are permitted to make use of this average number, we may well say that the quantity of microbes transmitted into the rabbits along with blood, was not very far off this number. We are, however, well justified in taking it somewhat higher, from the fact that a portion of the bacteria in the blood are occurring in twos, which will not be easily separated by mixing with gelatine, in which they will give rise to but one colony.

This relative scarcity of the micro-organisms of chicken-cholera in the heart-blood of rabbits, *newly dead*, stood in a sharp contrast to the relative abundance of these microbes in samples of the same blood, taken from rabbits *which had been left* where they died untouched, (say) for *twelve*, *twenty-four*, *thirty-six*, or *more hours*. In each case, where such a comparison was made — for that purpose one portion of the rabbits, as used for the inoculations, were examined soon after their death, and the other corresponding portion at some time after their death; but also on other occasions, when I had an opportunity of thus comparing,—I could not fail to be struck with the disparity of the heart-blood alluded to.

On the other hand, it was repeatedly noticed that the capillary-blood derived from cut surfaces of the liver, soon after the death of the rabbits, contained incomparably more numerous bacteria than the heart-blood derived from the same subject, and at the same time.

I must add that all the samples for microscopical examination were derived in like quantities, and spread and stained on cover-glasses in like fashion. From this it is evident that in rabbits dead of "chicken-cholera," at the time of death or shortly after it, the blood of the heart and main vessels carries only a relatively small number of the bacteria, and that their relatively plentiful

occurrence there, some such time after death as noted above, can only be declared by their having multiplied there after the death of their hosts.

The table, the arrangement of which will, I think, be easily understood, contains the results of this experiment. I may at once remark that, for the sake of convenience, those rabbits which as having died first were used for the successive inoculations of the different series (column one), are designated uniformly by the first (odd) number (column two) of each series. (See Table III., at the end.)

In looking over the figures in this table, we cannot help arriving at the conclusion that by transmitting the virus of chicken-cholera from rabbit to rabbit, to the extent of twenty generations, neither an increase, nor a decrease in its virulence is attained—that, rather, its virulence does not exhibit any striking differences throughout the whole series. It is true that in four cases out of the forty, the figures regarding time of death are a little lower than usual (Nos. 1, 21, 29, 33), that in three other cases they are somewhat higher (Nos. 4, 14, 28), and that in one case (No. 34) the figure is very high. But these exceptions may be declared from certain individual properties of the rabbits employed. It was, as a matter of fact, not possible to take exclusively only such rabbits as were like one another in every respect (age, size, weight, sex, and health).

That the rabbit No. 34, Series XVII.—a light-grey female, with a white streak running longitudinally from the back of the head over the middle of the head down to the underside of the neck (mammary glands fully developed, containing milk)—did not succumb until two days after inoculation, which had been performed in the usual manner, is very remarkable. Seeing it outlive the first day, I thought of having hit upon another example of immunity in rabbits. The *post-mortem* examination later on left no doubt as to its having died of "chicken-cholera." I may, however, mention that the seat of inoculation differed from that in all rabbits inoculated, in so far as there was a yellowish-white membraneous formation adhering to

the under surface of the cutis, of about the size of a sixpence. This appearance was not unlike that which is noticed at the seat of inoculation with the virus of chicken-cholera in the case of fowls and pigeons; but while the substance of the yellowish subcutaneous masses forming after inoculation in fowls and pigeons are found to be crowded with chicken-cholera bacteria, in the corresponding case of the rabbit these bacteria were exceedingly scarce.

Tests of Virulence with regard to Fowls and Pigeons.

The next table (IV.), at the end, contains the results of inoculations into fowls and pigeons, with heart-blood from the first-mentioned rabbits as used in the Inoculation Series v., x., xv., xx., of Table III. In reference to the first case which I denoted as inoculated from Inoculation Series I., I must state that, as the date (16th October) implies, that particular rabbit was not exactly the first dead of the first generation as followed directly by the others; this experiment was added later on, when, on 14th October, a pigeon was inoculated with a small quantity of the surface-growth of a gelatine stick-culture of the microbe (fifth generation, 17 days old), and after the death of the pigeon, which died between 14 h. 15 m. and 17 h. 5 m., a rabbit was inoculated (15th October) in pretty much the same way as the two of the first series in Table III. From this rabbit, which died between 12 h. 30 m. and 15 h. 45 m., the fowl and pigeon of Series I. of the following table were inoculated. Therefore, I call Series No. I. simply inoculated from Inoculation Series I. The conditions under which the five series were inoculated, were, on the whole, corresponding to those stated for the rabbits (Table III.); the seat of inoculation was an area under the skin which covers the pectoral muscle. (See Table IV.)

As evidenced by the data obtained and put together in this table, the virulence of the microbes of chicken-cholera neither increases nor decreases, perceptibly, in fowls and pigeons inoculated with virus descending from rabbits of the first, fifth, tenth, fifteenth, or twentieth Inoculation Series. The hours which it

required to kill either fowls or pigeons, did not show any considerable difference in either the one or the other case, so that we may say here, as we did before, that the degree of virulence was at the end of the experiment practically the same as at the beginning.

Notes on the Body Temperatures of Rabbits inoculated with the Microbes of Chicken-cholera.

In connection with the experiment conducted with a view to determining the degree of virulence of the bacteria of chicken-cholera, when made to pass though the bodies of rabbits in twenty generations of two rabbits for each, I have been able to make a series of observations regarding the body-temperatures of such rabbits.*

In a number of cases the temperature was taken, at intervals, from the time of inoculation (immediately before it) until death (immediately after it); in several instances only up to some time before death.

These observations are put together in Table V., at the end.

From the data given in this table we may reasonably conclude that—

1. As *a priori* intelligible, the septicæmia which is the result of transmitting virulent chicken-cholera bacteria into rabbits, is associated with a gradual increase in the body-temperature, which in its maximum was found to differ from the initial temperature by 2·5° C. in one case (No. 8), by 1·95° C. in another (No. 2), by 1·9° C. in a third (No. 7), by 1·8° C. in two others (Nos. 10 and 16), while in the remaining cases the difference was less.
2. This maximum, as a rule, is noticed some little time before death.

The difference between the initial body-temperatures (taken immediately before inoculation) and the final body-temperatures (taken immediately after death) may also be seen, in the

* The observations were made by means of an ordinary clinical thermometer which, after having been oiled with *ol. amygd. dulc.*, was introduced into the anus to the length of between six and seven centimètres.

majority of cases, as noted in the aforementioned table. Apart from these, I can offer several examples where only initial and final temperatures were taken. All the examples that may thus be utilised, number nineteen. The following are the figures as compared with one another in the different instances :—

40·0 —39·6 :	39·2 —39·67 :	39·6—40·6 :	39·3—41·0 :
38·9 —39·6 :	39·1 —40·2 :	39·2—39·15 :	39·4—40·0 :
39·05—39·45 :	38·85—40·0 :	39·1—40·9 :	39·8—39·6 :
39·8 —41·25 :	39·0 —39·9 :	38·8—39·65 :	39·9—41·7 :
39·8 —40·2 :	39·6 —41·2 :	40·0—38·4 :	

In fifteen cases, then, out of nineteen, the body-temperature was found to be higher at the end than at the beginning. Taking the mean out of each of these two series of fifteen observations, we arrive at the figures 39·3—40·355 ; the difference is thus 1·055° C. In four cases out of the above nineteen the final temperature was lower than the beginning. Taking, again, the mean out of each of the two series of four observations, we obtain the figures 39·75—39·19, that is a difference of 0·56° C. in favour of the final temperature.

From this, therefore, we may deduce that, as a rule, the final body-temperature is higher than the initial by about 1° C. on the average.

I may add the initial temperatures of eleven more cases, without any corresponding final temperatures. They were 39·9, 39·85, 40·2, 40·0, 39·45, 39·3, 40·1, 39·4, 38·7, 39·0, 39·6. The final temperature in one case, without any initial temperature taken, was 41·25.*

Although the temperatures which the air showed during the course of the experiments recorded above (Table III), may be regarded as having only a secondary meaning in the judgment of the results obtained, it is just as well to give a number of figures as they were noted.† They show here and there marked differences (see next page) :—

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*Note on the Respiration.—The breathing, shortly before death, is very much accelerated. In one instance, two minutes before the death of the rabbit, I have found it to be forty-six to $\frac{1}{4}$ minute ; in another instance, ten minutes before death, forty-four to $\frac{1}{4}$ minute.

† These figures are also put down in connection with certain statements as to the relative quantity of bacteria in the blood of rabbits, some time after their death of "chicken-cholera," *vide* above.

October 4th.	1.35 p.m. 25°	3.35 p.m. $25\frac{1}{2}$°	5.35 p.m. $22\frac{1}{2}$°	7.35 p.m. 20°	9.40 p.m. $18\frac{3}{4}$°			
,, 5th.	2.10 p.m. 21°	4.10 p.m. $19\frac{1}{4}$°	6.45 p.m. $17\frac{1}{4}$°	8.55 p.m. 16°	11 p.m. $14\frac{1}{2}$°			
,, 6th.	2.5 a.m, $11\frac{1}{2}$°	5.40 a.m. $9\frac{1}{2}$°	10 a.m. 19°	12.10 p.m. $22\frac{1}{4}$°	2.15 p.m. $19\frac{3}{4}$°	4.15 p.m. $18\frac{3}{4}$°	7 p.m. $16\frac{1}{2}$°	8.40 p.m. $15\frac{1}{2}$°
,, 7th.	9 a.m. $18\frac{3}{4}$°	10.40 a.m. $21\frac{3}{4}$°	12.40 p.m. $26\frac{1}{4}$°	2.50 p.m. $24\frac{1}{4}$°	4.50 p.m. $20\frac{3}{4}$°	6.55 p.m. $19\frac{1}{2}$°	9 p.m. 19°	11.10 p.m. 19°
,, 8th.	1.30 a.m. $16\frac{1}{4}$°	4 p.m. $13\frac{3}{4}$°	5.5 p.m. 12°	7.30 p.m. 12°	8.55 p.m, 14°			
,, 9th.	8 a.m. $14\frac{3}{4}$°	10.55 a.m. 16°	1 p.m. $15\frac{1}{2}$°	3.10 p.m. $16\frac{3}{4}$°	5.10 p.m. $15\frac{1}{4}$°	7.20 p.m. $14\frac{1}{4}$°	9.20 p.m. 14°	11.31 p.m, $14\frac{1}{2}$°
,, 10th.	10.30 a.m. $17\frac{3}{4}$°	12.50 p.m. $18\frac{1}{4}$°	3.20 p.m. $17\frac{1}{2}$°	5.55 p.m. $15\frac{3}{4}$°	8 p.m. $15\frac{1}{2}$°	10.15 p.m. $12\frac{3}{4}$°		
,, 11th.	12.55 a.m. $12\frac{1}{2}$°	10 a.m. $19\frac{1}{4}$°	12.15 p.m. $21\frac{3}{4}$°	3.30 p.m. $21\frac{3}{4}$°	8.20 p.m. $16\frac{1}{4}$°	10.10 p.m. $15\frac{1}{2}$°	11.43 p.m, 14°	
,, 12th.	12.47 a.m. $12\frac{1}{2}$°	7.45 p.m. $17\frac{1}{2}$°						
,, 13th.	8.10 a.m, $17\frac{3}{4}$°	10.40 a.m. $21\frac{3}{4}$°	1.5 p.m. $23\frac{1}{2}$°	6.10 p.m. $18\frac{3}{4}$°	8.10 p.m. 18°			
,, 14th.	1.15 a.m. $15\frac{1}{4}$°	12.50 p.m. $25\frac{1}{2}$°	3.25 p.m. $23\frac{1}{4}$°	6 p.m. 18°	8.10 p.m. $17\frac{1}{2}$°	10.15 p.m. $17\frac{1}{2}$°		
,, 15th.	5.40 p.m. 18°	8.10 p.m. 17°	10.30 p.m. $15\frac{3}{4}$°					
,, 16th.	3.5 a.m, $12\frac{3}{4}$°	7.20 a.m. 15°						

Experiments on Indigenous Birds.

In the appended Table VI.—*(a, b, c, d)* are put together, seriatim, the results of experiments with the microbes of chicken-cholera on a number of indigenous birds. These consisted of :—

(1) Two wekas, or Maori- or wood-hens *(Ocydromus australis*, Sparrm). *Habitat :* South Island of N.Z.

(2) Two magpies *(Gymnorhina tibicen*, Lath.). *Hab. :* Q., N.S.W., V., S.A.

(3) Two laughing-jackasses *(Dacelo gigas*, Bodd.). *Hab. :* Q., N.S.W., V.

(4) Two butcher-birds *(Cracticus torquatus*, Lath.). *Hab. :* Q., N.S.W., V., S.A.

(5) One blue-jay *(Graucalus melanops*, Lath.). *Hab. :* Austral. (and New Guinea).

(6) Two gallahs, or rose-breasted cockatoos (*Cacatua roseicapilla*, Vieill.). *Hab. :* Austral.

(7) Two wonga-pigeons *(Leucosarcia picata*, Lath.). *Hab. :* Q., N.S.W., V.

(8) One bronze-wing pigeon *(Phaps chalcoptera*, Lath.). *Hab. :* Austral.

(9) Two common swamp-quail *(Synoicus australis*, Lath.). *Hab. :* Austral.*

[See Table VI. *(a)*, *(b)*, *(c)*, *(d)*, at the end.]

(10) Six crows *(Corone australis*, Gould). *Hab. :* Austral. (See p. 560.)

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* All the specimens of birds mentioned under 1—9, were obtained, in an apparently good condition, from a dealer at the Sydney markets, on the 8th October. On the Island they were kept in spacious, airy boxes, so as to be protected from any injurious effects of the weather. When they were to be experimented upon (in case of feeding only), they were slightly starved beforehand, and their boxes emptied of all except water. During the course of the experiments they were regularly fed, as usual.

From the results so far obtained we see that the virus of chicken-cholera, derived, as it was, in the shape of blood from rabbits which died in consequence of infection by that virus, proved, when caused to gain entrance into the digestive organs in the noted quantities, fatal to the magpies, butcher-birds, and blue-jay (which are principally animal feeders), to the wonga- and bronze-wing pigeons, to the gallahs and quail (which are all of them vegetable feeders). One of the wonga-pigeons, however, and one of the quail, did not succumb until after having been fed a second time on somewhat larger portions of the virus than before. One of the gallahs, although surviving two experiments by feeding, perished quickly in consequence of inoculation, thus manifesting its ready susceptibility to inoculated chicken-cholera.

Of two laughing-jackasses (true animal-feeders), one died after the first experiment (feeding), but not of chicken-cholera, as shown by the result of the *post-mortem* examination. The other survived feeding on virulent material for two successive times; but when inoculated later on, it succumbed, we are entitled to say, to this disease, in so far as evidenced by the occurrence of numerous bacteria of chicken-cholera in the blood, by their successful cultivation, and inoculation into a healthy rabbit, which died as usual. The appearance of the organs was less characteristic than is usually the case with birds dead of the disease.

Two wekas (animal-feeders), of which one was once fed and twice inoculated, the other twice fed and once inoculated, remained alive. Whether their insusceptibility arose from the fact of their having been possibly treated preventively at first, or whether—what seems to me to be not at all impossible—birds of this description are naturally immune against chicken-cholera in any shape of application, can only be decided by further experiments.

Nearly five and a half months later, the two wekas (rooster and hen) were subjected to a last inoculation, this time of a considerably larger quantity of virulent blood from a "chicken-cholera" rabbit [see Table VI. (*d*)]. The result was that the weka-hen

remained alive for good, whereas the rooster was found dead 42 hours after inoculation (having died in less time than that). The inoculation, in this instance, had not run off smoothly; instead of applying, as intended, the same quantity as that injected into the hen (in each case under the skin of the right side of the breast), only about half of that penetrated under the skin; the animal may have become too much injured at the place of inoculation, in consequence of the manipulation. At the *post-mortem* examination, the seat of inoculation and neighbouring portions were in a state of hæmorrhagic infiltration. The organs presented everywhere indications of general sepsis. The blood, of black colour, showed in cover-glass preparations a moderate number of bacilli which, although being larger than the chicken-cholera bacteria usually are, resembled them. There were also bacilli of a different form. In order to arrive at a certainty whether the former were true chicken-cholera bacteria, and active, I inoculated a medium-sized fresh rabbit with heart-blood of the weka-rooster. The rabbit was found dead 20 hours afterwards, it having died between $10\frac{3}{4}$ hours and that time. The finding of the examination was: death from typical "chicken-cholera." Notwithstanding this occurrence of virulent bacteria in the heart-blood of the weka-rooster—they were also observed in the spleen—it is very doubtful whether this case is to be placed under the heading of a true infection by those microbes. To judge from the *post-mortem* appearances, I think, the presence of these microbes in the vascular system might be explained without adopting the view of an infection, properly speaking.

That with regard to all the representatives of indigenous birds which, experimented upon, died, the cause of death must be regarded as due to chicken-cholera, as briefly noted in the quoted table by "*P.M., Positive*" (with the exception of one laughing-jackass, where the *post-mortem* was negative, and very likely of the weka) was, I think, conclusively demonstrated by the presence, usually in immense numbers, of the typical bacteria in the blood; by cultivation of such material in suitable media, when they gave rise to typical cultures; and by the positive results of occasional

inoculations of blood into normal rabbits. Besides, the appearance of the organs was nearly always such as bearing a close resemblance to that in the case of fowls and pigeons which succumb to the disease.

Certain results obtained in the foregoing experiments, would seem to lead to the belief that indigenous birds, as exemplified by a few instances, may not always necessarily become affected or killed by taking up, along with food, certain small or minute quantities of the microbes derived, we had better add, directly from the bodies of rabbits newly dead of "chicken-cholera." On the other hand, inoculation with the virus taken from the same source, may be looked upon as a far more dangerous, although naturally more rarely occurring, mode of infection for such birds. Further below I shall mention a corresponding case in common pigeons.

(10.) Indigenous Crows.

At my request, Mr. Taylor, of the Rabbit Branch, Lands Department, Sydney, caused a number of indigenous crows to be caught near Hay, New South Wales, and to be forwarded to me. On the 8th and 10th November, 1888, I received them, eight in all, of which, however, two died soon after arrival. The remaining six appeared in good health, although at first they were a little sluggish. They belonged to the species *Corone australis*, Gould; found all over Australia, including Tasmania. I am told that there is very little difference between the two species of crows described from Australia; one is the above-mentioned, and the other is *Corvus coronoïdes*, Vig. and Horsf., which is said not to occur in Tasmania.

I enumerate the experiments upon the six crows in chronological order:—

1888.

(i) November 13th, 11 a.m.

Two of the crows, kept in one box with plenty of space in it, were inoculated (under the skin over the pectoral muscle on one side) with fresh virulent liver-blood taken from a rabbit which died of "chicken-cholera" on inoculation.

One received 1-16th ccm. = 1 minim
The *other* received 1-32nd ccm. = $\frac{1}{2}$ minim } of such blood.

Results :

November 15th.—The *one* which had been inoculated with 1 minim of blood, was found dead at 7.30 a.m. *P.M.*, *Positive.* (Appearance of the organs resembling to some extent that of the organs of poultry dead of chicken-cholera. Immense numbers of typical bacteria in the blood.)

December 1st.—The *other* which had received only $\frac{1}{2}$ minim of blood, was still alive on this date, when it was used otherwise, as will be seen below.

(ii) November 13th, 12.35 p.m.

Four crows which were accommodated in a commodious specially-fitted stall in the shed, and which had not been treated so far, were fed on the livers of two rabbits which had succumbed to "chicken-cholera" on feeding.

Annotations :

(1) The crows, although not being fed on the morning of that day, were very slow in eating the pieces of liver placed in their stall on a soup-plate.

(2) The feeding had, from want of rabbits at the time, to be discontinued until later (*vide* below).

Result :

December 1st.—The *four* crows were still alive.

(iii) December 1st to 7th.

In the stall which contained the above four crows, and into which was turned the one which had been inoculated previously with $\frac{1}{2}$ minim of virulent blood, were placed, for *seven* consecutive days, in the mornings, the carcasses, each time, of two rabbits which died of "chicken-cholera" on inoculation (in connection with the desiccation experiments (p. 572).

Annotations :

(1) The dead rabbits (*fourteen* in all), before being given to the crows, had been deprived of their entrails (with the exception of liver, kidneys, heart, and lungs), and as there were more on hand than were required at the time, they were kept in a cool place, so that the carcasses were still fresh when placed in the crows' stall, with the exception of one (out of the last feeding) in which putrefaction had already set in.

(2) During the above-mentioned period the crows did not receive any other food. Water, of course, was always provided.

Results :

December 4th.—*One* found dead at 9.30 a.m. (alive at 8.15 a.m.). *P.M.*, *Positive.* (Carcass stiff; blood coagulated, and of a tarry appearance; hyperæmia of intestines; contents of small intestine consisting of slimy, yellowish masses, stained here and there with extravasated blood; spleen apparently enlarged, cherry-brown. Immense numbers of bacteria of chicken-cholera in the blood. A healthy rabbit inoculated with a small quantity of such blood, succumbed promptly. Cultures derived from blood of this rabbit were further tested, so that with regard to this crow there cannot be any doubt as to the cause of its death).

December 9th.—*One* found dead at 8.30 a.m. *P.M.*, *Positive.*

The *three* remaining crows, among them the previously inoculated one, were still alive on

(iv) December 14th, when, at noon, they were inoculated with fresh virulent blood derived from the liver of a rabbit that died of "chicken-cholera" on inoculation. Of these three crows, two, of which one had been inoculated before, received 1 minim each of the blood; the third ½ minim.

Results :

All three crows remained alive and well, thus showing that they were altogether refractory to this treatment.

1889.

(v) April 8th, about noon.

After a lapse of nearly four months, the three crows were inoculated again, at the above time, with liver-blood from a rabbit recently dead from "chicken-cholera"; each crow received the rather large dose of ¼ ccm. (4 minims) of such blood injected under the skin of the left side of the thorax.

In the evening of the same day, and at noon of the following day, they were seen to have eaten only portion of the meat given to them.

Results :

One crow which some time ago had lost one of its feet through injury, died between 3 p.m. and 3.15 p.m., April 9th; 27 hours after inoculation. The carcass was found resting on a perch, and its head leaning against the wall.

A *second* crow which looked dull, and ruffled in plumage, in the evening of April 9th, was found dead at 6.25 a.m., April 10th; it was lying on the floor of the stall.

The *third* crow which also was ill since the previous evening, was found dead at 7.30 p.m., April 10th; lying on the floor; it must have died between 5.50 p.m. and that time.

(A vigorous full-grown rabbit, also inoculated with ¼ ccm. of that liver-blood, as control, was found dead at 7 a.m., April 9th. It must have died soon after 10 p.m., the previous night.)

The examination of the carcasses of the three crows, of which the last two were in a very good condition, resulted in showing that they all had succumbed to chicken-cholera. The carcasses were very stiff. At and round the seat of inoculation there was, in the case of the last two crows, a tough, yellowish-white formation, resembling in appearance what is known in fowls or pigeons similarly treated. Spleen conspicuously enlarged, cherry-brown, and soft. Intestines hyperæmic; hæmorrhagic exudations in the duodenum of the crow which died first. Blood mostly coagulated, blackish; in it innumerable numbers of the typical bacteria of chicken-cholera.

To judge from the outcome of these experiments we may say, generally, that the microbes of chicken-cholera are only under certain conditions fatal to crows. Small doses of the virus, it appears, are not efficacious enough to become fatal; on the other hand, repeated feedings on larger quantities of virulent material are more dangerous, while inoculations with larger quantities of such caused death (from chicken-cholera) each time. The previous treatment of the crows mentioned under iii and iv, may have had something to do with the surviving of the greater portion (iii), or of all of them (iv). These treatments combined, were, however, unable to protect—if there was any protection at all—the three crows, when they were subjected to a severer test, about four months later.

How far there is danger for all the useful indigenous birds to take up the disease (chicken-cholera), should the latter be introduced into the country for the sake of rabbit-destruction, cannot be precisely defined from the results of the above experiments. That such a danger, however slight it may be, does exist, if the disease was intentionally spread and reared in the open, cannot be denied by the unprejudiced mind; and that, even admitting that in the

first instance only a minute fraction of wild birds may be carried off by the disease—an occurrence which in itself would be of little importance—these few birds, travelling as they may, perhaps, after having become infected, may transmit the germs hither and thither, ready to be taken up again by susceptible birds of the same or some other description.

Experiments on Common Fowls and Pigeons.

(a).

Feeding and Inoculation.

On page 553 and Table IV. (at the end), I have already recorded certain inoculation-experiments with reference to common fowls and pigeons. This was in association with the experiments on the behaviour of chicken-cholera bacteria when removed from rabbit to rabbit through twenty generations.

Table VII. (at the end), (*a*, *b*, *c*, *d*, *e*), contains an account of the arrangement and the results of other experiments.

From it will be seen that one fowl (hen) proved insusceptible to taking chicken-cholera by feeding on a small portion of virulent material from a dead rabbit, while after a second feeding on a considerably larger portion it died, unfortunately, soon afterwards, from some cause different from chicken-cholera. (The result of the *post-mortem* examination is denoted as *negative* in the table). Another fowl (heavy rooster) was fed three consecutive times on successively larger portions of virulent material (taken from rabbits) without the least harm to its health. Later on it was inoculated with a small quantity of active microbes, but it remained alive. [Necrotised tissue was thrown out where the seat of inoculation was, corresponding to what takes place in fowls which are treated preventively with attenuated virus of chicken-cholera (Pasteur)].

The immunity of the rooster, in this instance, was possibly due to the animal having undergone three previous and successive feeding experiments, which might have had a protective influence.

Nearly five months and a-half later, the rooster, which was then very robust, received subcutaneously (breast) a much larger quantity of virulent rabbit-blood [see Table VII. (at the end) (*e*)]. This time the rooster did not resist; it died, under the typical chicken-cholera symptoms, 27 hours after inoculation, after a short illness. The *post-mortem* examination revealed an example of severe chicken-cholera. The duodenum was filled with almost one mass of blood.

Two pigeons which were repeatedly fed (the one twice, the other three times) on food contaminated with active microbes, succumbed promptly to the effects of inoculation later on, thus showing that they had not been rendered immune by the previous treatments. However, in the judgment of these results, it should be borne in mind that, as the pigeons were too slow in eating (see Table VII.), the preceding treatments (feeding) cannot be regarded as exact. (The results of the *post-mortem* examinations are simply denoted as *positive* in the table.)

(b).

Experiment with a view to ascertaining the effect of exposing poultry to rabbits which are dying from "chicken-cholera" (after feeding), and the carcasses of which are allowed to remain with the former for some time.

For this purpose the Aviary on the Island, shortly described in the Introduction, was utilised. At the beginning of the experiment, November 9th, 1888, it contained nine fowls, (of which three had been there for some time, as left over from a former consignment of twelve, and six had been received from the Sydney Markets the day before, November 8th), and twelve pigeons, also obtained from the Markets on the latter date. Neither the fowls nor the pigeons had so far been experimented upon in any way.

The experiment, as already mentioned, was begun November 9th, and lasted five weeks, up to December 14th.

Within this period rabbits were introduced, at intervals, in all three times.

1888.

(i) November 9th, 10 a.m.

Two rabbits, one quite full-grown, the other nearly full-grown, were given cabbage-leaves sprinkled with 3 ccm. of an active broth-culture for each rabbit. When seen at 12.15 p.m., they had finished their portions of infected food.

At 12.30 p.m. they were let go in the aviary.

Results :

One observed to die at 10 a.m., November 10th; the other about two hours later, at 12.7 p.m., both under "chicken-cholera" symptoms. Their carcasses also showed the typical stiffness. A control-rabbit which was found dead at 7.30 a.m., November 10th, was, on examination, proved to have succumbed to "chicken-cholera."

(ii) November 22nd, 11 a.m.

Three full-grown rabbits, having besides others arrived on the Island on the previous day, were given cabbage-leaves with 2 ccm. of a fresh broth-culture for each rabbit (at the same time six other rabbits were similarly fed, see p. 538). The three rabbits which were very slow in eating, although they had been left without food for some time, were placed in the aviary at 7 p.m.

Results :

One rabbit found dead at 7 a.m., November 23rd. As check for its having died from "chicken-cholera" may be taken a rabbit which, being among the six mentioned (turned into the main enclosure), was also found dead at 7 a.m., November 23rd; a sample of liver derived from this rabbit, contained the typical chicken-cholera bacteria. The *two* other rabbits being still alive, November 27th, were taken out of the aviary that day.

(iii) November 28th, 11 a.m.

Three full-grown rabbits were given green barley-leaves sprinkled with 2 ccm. of a fresh broth-culture for each rabbit. Two of them were seen to have eaten their portions of infected food at noon, the third at 1 p.m. At 3.15 p.m. they were transferred to the aviary.

Results :

One found dead at 7.30 a.m., November 29th.

Another found dead at 6 p.m., December 1st; seen alive an hour before.

In these two cases a sample of liver was derived, as described pp. 538, 539. The microscopical examination yielded large numbers of typical bacteria.

The *third* being still alive, December 14th, was removed from the aviary.

Thus *five* rabbits died in the aviary from "chicken-cholera," *two* November 10th, *one* November 23rd, *two* November 29th

and December 1st, respectively. The carcasses remained there until December 14th (see above).

Now, with regard to the poultry, penned up in the same aviary, I have to state that within the five weeks there died: *six* pigeons and *two* fowls. However, early on Nov. 10th, *i.e.*, very soon after the beginning of the experiment, *two* pigeons which were ailing before, were found dead. Leaving these two out altogether, the mortality, and the result of *post-mortem* examination, is as follows:—

November 13th—*One* hen found dead at 7.30 a.m. *P.M., Negative.*
November 17th—*One* pigeon found dead. *P.M., Negative.*
November 29th—*One* rooster found dead at 7.30 a.m. *P.M., Negative.*
December 7th—*One* pigeon found dead at 8 a.m. *P.M., Negative.*
December 11th—*One* pigeon found dead at 8.30 a.m. *P.M., Negative.*
December 14th—*One* pigeon found dead at 8 a.m. *P.M., Positive.*
(Characteristic appearance of organs: immense numbers of chicken-cholera bacteria in blood. Rabbit inoculated with small quantity of this blood perished from "chicken-cholera" in less than 10 hours after inoculation).

Thus, it was only once, namely in the case of the last pigeon, that the disease was communicated.* This result appears to rabbits dying and dead from "chicken-cholera," is not great under indicate that the danger to poultry which are associated with those conditions.

It must be mentioned that during the term of the experiment both fowls and pigeons were observed to peck freely at the dead rabbits lying about. When the latter were removed ultimately, the three rabbits which had died first, presented only fragments scattered in different directions. The two which died last, were

* After December 14th, another death occurred in the aviary, namely that of a hen which was found dead at 7 a.m., December 15th. The result of the *P.M.* examination, and the successful inoculation of some heart-blood of this hen into a healthy rabbit, was undoubted proof of death being due to chicken-cholera. It cannot, however, be decided whether this hen died in consequence of infection from the dead rabbits which were in the aviary up to December 14th, or of infection from the droppings of the pigeon which, having been found dead on the last-mentioned date, was shown to have succumbed to chicken-cholera.

not dismembered, but they were pecked open, and their flesh and entrails mostly missing.

EXPERIMENTS ON HARES.

Below are recorded a few experiments with the chicken-cholera microbes on hares.* It will be seen that these rodents (which were employed in full-grown specimens) are as easily amenable to "chicken-cholera" as rabbits.

1888.

(i) August 11th, 3.30 p.m.

A hare was *inoculated* with five small platinum-loops full (about 1-40th ccm.) of virulent blood from a rabbit that had died after inoculation with a small quantity of a virulent broth-culture of the microbe.

Control :—A control-rabbit (full-grown) was found dead at 9 a.m., August 12th. *P.M., Positive.*

Result :

The hare was found dead at 9 a.m., August 12th. *P.M., Positive.*

(ii) August 11th, 4 p.m.

A hare was *fed* upon a few cabbage-leaves infected, by means of a platinum-loop, with about ¼ ccm. of blood from the same infected rabbit from which blood was taken for the inoculation of a hare this date [*vide* (i) above]. It was not until 10 p.m. (*i.e.*, six hours after the infected food had been placed in the box) that the hare was observed to have eaten all the infected food given to it.

Control :—A control-rabbit which had finished eating its portion of infected food shortly after the food was placed in its box, was found dead at 8.30 p.m., August 12th, having died between 5.30 p.m. and that time (*i.e.*, between 25½ and 28½ hours after being fed). *P.M., Positive.*

Result :

The hare was still alive at 11.30 a.m., August 16th (*i.e.*, about 8 days after the feeding referred to above).

(iii) August 16th, 11.30 a.m.

(*a*) The same hare was *fed* upon cabbage-leaves infected with 1½ ccm. of a virulent broth-culture of the microbe.

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* The hares used here were among five robust specimens received from the country, through Mr. H. C. Taylor, Rabbit Branch, Lands Department, Sydney.

(*b*) Another hare (which had survived from inoculation with some dried blood taken by Dr. Bancroft, of Brisbane, Q., from a hare that had died in captivity) was *fed* upon cabbage-leaves infected with 1½ ccm. of the same culture.

Control :

(*a*) Of *two* control-rabbits (large vigorous animals ; both *tame*†), *fed* together in the same box upon food infected with 3 ccm. of the same culture, *one* (a long-haired black specimen) was found dead at 8.45 p.m., August 18th (*i.e.*, about 57 hours after being fed). *P.M.*, *Positive.*

The *other* (a long-haired albino) was still alive on August 20th. (For further treatment of this particular rabbit *vide* pp. 523-525.)

(*b*) A control-rabbit (a tame long-haired albino) *inoculated* with a small quantity of the same culture, was found dead at 8 a.m., August 17th.

Results :

Both hares were found dead at 8 a.m., August 17th. *P.M.* (in each case), *Positive.*

Feeding of Guinea-pigs on Chicken-cholera Microbes.

About guinea-pigs it is said that, when inoculated with such microbes, they generally react by the formation, at the seat of inoculation, of closed abscesses which, as a rule, pass away again without being followed by a general infection and, as consequence, by the death of the animals. I have not made any inoculation-experiments, but, on the other hand, tried the effects of virulent microbes introduced into guinea-pigs through the alimentary canal.

On May 10th, 1889, at 2.30 p.m., 12 ccm. of a virulent broth-culture of the microbes—obtained from virulent heart-blood of a rabbit, and incubated for 24 hours at 37·75-37·9°C.—were uniformly sprinkled on, and made to adhere to, fresh cabbage-leaves which were placed in a large box

† Several tame rabbits (Angora) were sent to the Island in June, 1888, by Professor Watson, of Adelaide, S.A. Most of those which were not used for chicken-cholera experiments, exhibited "scab" later on, with which, I believe, they, or at least a portion, had been infected by Professor Watson.

containing five well-nourished guinea-pigs, namely : *three* young ones, about ¼-year old ; *one* (doe) not quite full-grown, about ½-year old , *one* (doe) quite full-grown. They all had been kept hungry for a while. At the same time, or rather a little before, a fresh rabbit was given 4 ccm. of the same broth-culture ; this rabbit which served in particular as control to two previously-treated rabbits, died about 24 hours after feeding (see pp. 528,529).

Results :

One guinea-pig, the ½-year old doe, died at 10.45 a.m., May 12th, the symptoms shortly before death being similar to those noticeable in "chicken-cholera" rabbits.

Another, the full-grown doe, died at 3 30 p.m., May 12th, in pretty much the same way as the preceding one.

The *three* ¼-year old guinea-pigs remained alive, somewhat to my surprise. They were watched for weeks afterwards, but were never seen to show any signs of illness. It should be mentioned that they were observed eating the infected food just as well as the two others which subsequently died, and that they must have partaken of it in proportion.

At the *post-mortem* examination of the two guinea-pigs, it was first noticed that *rigor mortis* was very well marked. On removing the skin at the belly, the veins were seen to be gorged with blood. There was a severe peritonitis and pleuritis, especially in the old guinea-pig. Heart distended with blood, which was of a blackish colour. Lungs very voluminous, reddish-white, here and there intersected with darker spots ; on section frothy, crepitating. Spleen enlarged, of apparently usual colour. Stomach filled with food. Intestinal canal very strongly hyperæmic ; in one case (full-grown female) the small intestine at different places containing blood-stained liquid masses ; in the other (younger female) the whole of the small intestine showing externally a dark cherry-red colour, and on being cut open, showing the contents consisting of liquid material very rich in blood. Something similar to such a degree of extravasation of blood into the intestines, I have occasionally met with in birds dead from chicken-cholera. The rectum contained solid, although soft, greenish fæces.

Cover-glass preparations of blood from heart and liver showed moderate numbers of "chicken-cholera" bacteria ; these were, on the other hand, exceedingly abundant in sap from cut-surfaces of the lungs.

A stick-culture, derived from heart-blood, in ordinary nutrient gelatine, was in its appearance exactly like others obtained from blood of rabbits or birds which died from "chicken-cholera."

Experiments on Ferrets.*

In the following is given the enumeration of experiments with chicken-cholera microbes on ferrets. Certain carnivorous animals, as dogs and cats, are already sufficiently known to be insusceptible to these microbes, and from the results obtained with regard to ferrets, it may reasonably be inferred that the latter are equally inaccessible to them.

1888.

(*a*) *Inoculation.*

(i) With *culture.*

September 10th, 11.30 a.m.

Two ferrets (one male, one female) were inoculated with $\frac{1}{8}$ ccm. of a virulent broth-culture of the microbe of chicken-cholera, obtained directly from blood of a rabbit that had died of "chicken-cholera."

Control:—A control-rabbit was found dead at 7.50 p.m. the same day (*i.e.*, about $8\frac{1}{4}$ hours after being inoculated). *P.M.*, *Positive.*

Results:

On being fed, at 9 a.m. on the 11th September, the two ferrets appeared dull and feverish. Both drank water freely before touching the meat or porridge and milk given to them, and when they took up the pieces of meat, did not tear at them ravenously, as was their wont before. So they remained for some time. The seat of inoculation showed some special reaction, which in one (the female) subsided gradually, while the condition of the other (male) became worse and worse, till it succumbed on the 18th September.

P.M.—Extensive gangrene round the seat of inoculation; organs abnormal; absence of any micro-organisms in preparations from heart-blood and spleen.

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* The ferrets referred to in these experiments were sent to the Rabbit Commission by the Government of New Zealand, and were received at Rodd Island on the 31st August. Ferrets are here and there in the Australasian Colonies employed for the destruction of rabbits.

A rabbit inoculated with a small quantity of heart-blood from this ferret, died during the night in consequence of some injuries accidentally received in its hutch.

(ii) With *blood*.

September 11th, 12.50 p.m.

Two fresh ferrets (one male, one female) were inoculated *each* with five platinum-loops full (about 1-50th ccm.) of heart-blood from a rabbit that had died of "chicken-cholera" (inoculation).

Control:—A control-rabbit was found dead at 7.30 a.m. on the 12th September. *P.M.*, *Positive*.

Results:

The seat of inoculation did not show any special reaction. The two ferrets appeared somewhat sluggish at first, but very soon afterwards behaved as before.

(*b*) *Feeding*.

(i) September 12th.

Three fresh ferrets (one male, two females) were fed together upon 30 grammes (about 1·07 oz.) of virulent liver taken from a rabbit newly dead of "chicken-cholera" (inoculation).

Results:

The ferrets did not appear to show any reaction whatever.

(ii) September 18th.

Two fresh ferrets (one male, one female) were fed together upon 45 grammes (about 1·6 oz.) of virulent liver from a rabbit newly dead of "chicken-cholera" (inoculation).

Results:

The ferrets did not show any signs of illness. They remained alive, like the former.

Effect of Desiccation.

In accordance with a desire expressed by the Rabbit Commission at one of its meetings, I have carried out some experiments with a view to testing the influence of desiccation on the microbes of chicken-cholera.

It should be mentioned here that, as more than one observer tells us, the virus of chicken-cholera becomes innocuous by drying up, and that this peculiarity in the life-history of those microbes furnishes an easy and practical means of getting rid of them, wherever they are deposited in poultry-yards. The bacteria of

chicken-cholera are not known to form spores or seeds (as, for instance, the anthrax-bacilli do), by means of which they are able to live under adverse circumstances.

I have to record three series of experiments.

The general plan of procedure was as follows:—A number of silk-threads—of the kind used in surgery—of 1 centimètre in length and $\frac{1}{2}$ to $\frac{5}{8}$ millimètre in thickness, were placed in a sterile cotton-wool-plugged test-tube, and after having been thoroughly moistened with distilled water, were exposed in the steam-steriliser to steam of 100° C. (212° Fahr.) for two hours. The moisture remaining in the silk-threads and in the tube, was got rid of by placing the latter in a copper-box heated up to 100—105° C. (212—221° Fahr.) as long as required.

The virulent material to be tested for its resistance to desiccation consisted, on the one hand, of blood taken from the liver of rabbits which died on inoculation, on the other hand, of fresh broth-cultures derived directly from blood of rabbits newly dead of "chicken-cholera" on inoculation.

The silk-threads referred to above were impregnated with either blood or culture.

In case they were to be impregnated with blood, they were placed on cut-surfaces of the liver, where they remained until they were completely soaked. The livers of all the rabbits used were, I may mention, not otherwise diseased.

In case the threads were to be charged with broth-culture, a small quantity of the latter was placed, by means of a sterile pipette, in a sterile watch-glass, where they remained for some time.

The silk-threads, thus treated either with blood or culture, were then transferred to different places where they could dry up, as will be seen from what follows below. Within certain intervals a silk-thread of both the one and the other description was inoculated into a rabbit each, whereby the virulence or non-virulence of the administered material was to be ascertained. The threads

were in each case deposited in small pouches produced under the skin of the rabbits on the left side of the belly.

I think it necessary to say that every detail of the experiments was managed under due precautions.

1888. *Series I.*

Silk-threads saturated, November 28th, 11 a.m., with fresh liver-blood (containing large numbers of bacteria), and others saturated with fresh broth-culture of the microbes (this culture had been in the thermostat for a day at 39-39½° C., and for another day in the room at a temperature up to 25° C.), were placed on a piece of sterilised brass-wire-gauze in a desiccator over chloride of calcium. This desiccator was placed, immediately after the threads were put in, in the cupboard of a room where the temperature kept pretty even.

The virulence of the material employed (blood and broth-culture) was controlled by means of inoculation of a silk-thread impregnated with either blood or culture into a rabbit each. Both rabbits died promptly of "chicken-cholera," ten and twelve hours, respectively, after inoculation.

Silk-threads were taken out of the desiccator and inoculated into rabbits after 2, 4, 6, 8, 10, 12, 24, 36, 48, 72, 96, 120, 144 hours from the beginning of the experiment.

Within this period of six days, from November 20th to December 5th, the temperature near where the desiccator stood, fluctuated between 21¾° C. and 18° C.

Details about temperatures are given in the following table :—

DATE.	TEMPERATURES.
November 29th...	Between 11 a.m. and 11 p.m.: Highest, 21½° C. Lowest, 21° C.
,, 30th...	Between 11 a.m. and 11 p.m.: Highest, 20° C. Lowest, 19° C.
December 1st......	Between 11 a.m. and 10 p.m.: Highest, 18½° C. Lowest, 18° C.
,, 2nd.....	Between 10 a.m. and 5 p.m.: Highest, 19½° C. Lowest, 18° C.
,, 3rd.....	Between 10 a.m. and 10 p.m.: Highest, 20° C. Lowest, 18½° C.
,, 4th	Between 9 a.m. and 9 p.m.: Highest, 21¾° C. Lowest, 19° C.
,, 5th......	At 11 a.m.: 21¾° C.

The result was that the blood which was under the influence of desiccation for three days at the above temperatures, was still able to infect a rabbit, and cause it to perish of "chicken-cholera" (about twenty-one hours after inoculation), whereas after four, five, and six days from the beginning, the desiccated blood had lost its virulence.

On the other hand, the desiccated broth-culture preserved its virulence so far that after two days from the beginning it was still able to kill a rabbit (about twenty-seven hours after inoculation), whereas it was not any longer efficacious when inoculated after three, four, five, and six days' desiccation.

Series II.

Silk-threads saturated, December 7th, 10 a.m., with fresh liver-blood (containing large numbers of bacteria), and others saturated with fresh broth-culture (having been for twenty-four hours in the thermostat at 40° C.—37° C.), were placed on a thin layer of sterilised sandy soil (dry) at the bottom of a shallow basket made of fine brass-wire-netting. (The bottom of this basket had been bent up a little where the sandy soil was put on). The basket was then immediately after placed on a piece of wood, at a distance of about 2½ feet from the ground, in the main enclosure, at a spot which was shaded off by means of a wooden post and of boards, so as to leave the spot only at the south side free and accessible. The basket was sheltered from rain by putting coverings over the top of the boards mentioned.

The virulence of the original material (blood and broth-culture) was tested by inoculating rabbits, one with silk-thread charged with blood, and the other with silk-thread containing broth-culture. Both rabbits died of "chicken-cholera," 10 and 21 hours, respectively, after inoculation.

The effect of the drying-up of the silk-threads was ascertained by inoculating rabbits after 4, 8, 12, 24, 48, 72, 96, 120 hours from the beginning. Within this period, from December 7th, 10.15 a.m., to December 12th, 10.15 a.m., the thermometer in the shaded place registered temperatures of between 20½° C. (lowest) and 29¼° C. (highest).

The following Table contains details about the Temperatures, and general remarks on the Atmosphere during that time:—

DATE.	TEMPERATURES IN THE SHADED PLACE.	REMARKS.
December 7th	Between 10.15 a.m. and 2.15 p.m.: Highest 25° C.; lowest $23\frac{3}{4}$° C. ,, 2.15 p.m. ,, 6.15 p.m.: ,, $24\frac{1}{2}$° C.; ,, 22° C. ,, 6.15 p.m. ,, 10.15 p.m.: ,, 22° C.; ,, 21° C.	Air dry. Light S. breeze all day.
8th	,, 9.40 a.m. ,, 10.15 a.m.: ,, $28\frac{1}{8}$° C.; ,, $27\frac{3}{4}$° C. ,, 10.15 a.m. ,, 4.30 p.m.: ,, $28\frac{2}{3}$° C.; ,, 25° C. ,, 4.30 p.m. ,, 9.50 p.m.: ,, 25° C.; ,, $22\frac{1}{4}$° C.	Air dry. Very calm.
9th	,, 9.30 a.m. ,, 11.30 a.m.: ,, $21\frac{1}{2}$° C.; ,, $21\frac{1}{4}$° C. ,, 11.30 a.m. ,, 10 p.m.: ,, $22\frac{3}{4}$° C.; ,, 21° C.	Air dry. S. breeze all day.
10th	,, 8.15 a.m. ,, 9.45 a.m.: ,, $27\frac{3}{4}$° C.; ,, 26° C. ,, 9.45 a.m. ,, 2.15 p.m.: ,, $29\frac{1}{4}$° C.; ,, $25\frac{1}{2}$° C. ,, 2.15 p.m. ,, 10 p.m.: ,, $25\frac{1}{2}$° C.; ,, 21° C.	Air dry, until afternoon, when thunderstorm set in with rain for about half an hour.
11th	,, 8.30 a.m. ,, 4 p.m.: ,, $26\frac{1}{4}$° C.; ,, $25\frac{1}{2}$° C. ,, 4 p.m. ,, 10 p.m.: ,, $25\frac{1}{2}$° C.; ,, $21\frac{1}{4}$° C.	S. breeze morning. E. breeze afternoon. Strong E. wind evening
12th	,, 8.30 a.m. ,, 10.15 a.m.: ,, $22\frac{1}{3}$° C.; ,, $20\frac{1}{2}$° C.	Calm morning.

The result was this :—

The blood thus exposed to desiccation preserved its virulence when inoculated after four, eight, and twelve hours; when inoculated after twenty-four hours and more from the beginning, it had ost its efficacy on rabbits.

The desiccated broth-culture proved virulent only when inoculated four hours after the beginning of the experiment. The rabbit succumbed to "chicken-cholera" twenty-six hours after inoculation. Subsequent inoculations, eight, twelve, and more hours after the beginning, were attended with negative results.

Series III.

Silk-threads saturated, December 7th, 10 a.m., with virulent material (blood and broth-culture) derived from the same sources as the material used in *Series II.*, were placed on sterilised dry sandy soil, which in a thin layer covered the bottom of a small shallow wire-gauze basket, similar to that in *Series II.*

Annotation: Control of virulence as in *Series II.*

At 10.10 a.m., same day, this basket was placed on some available spot on the Island; this spot was accessible to the sun's rays all day long. The bottom of the wire-basket was placed flat on the perfectly dry sandy surface of that spot. This latter was also accessible to the wind or breeze prevailing during the experiment.

The silk-threads remained there from 10.10 a.m. to 6.10 p.m., *i.e.*, for eight hours. Within this period rabbits were inoculated 1, 2, 4, 6, and 8 hours from the time the silk-threads were exposed.

A thermometer was laid on the soil near where the basket with the silk-threads stood. Details about the temperatures at the surface of the soil, during the course of the experiment, are given in the accompanying table.

December 7th:—

10.15 a.m., 45° C.; 10.45 a.m., 50° C.—Sunshine for about ten minutes.

11.15 a.m., 47° C.—Sunshine for about ten minutes since last observation.

11.45 a.m., 42¾° C.—Few minutes sunshine.

12 noon, 35° C.—Cloudy for about twelve of last fifteen minutes.

12.15 p.m., 38° C.—About five minutes sunshine.
12.45 p.m., 36° C.—About five minutes sunshine.
1.10 p.m., 39½° C.—A few minutes sunshine.
1.45 p.m., 42¼° C.—About fifteen minutes sunshine.
2.15 p.m., 38¼° C.—About twenty minutes sunshine.
2.45 p.m., 36¾° C.—Two or three minutes sunshine.
3.15 p.m., 38½° C.—A little sunshine.
3.45 p.m., 33½° C.—Very cloudy.
4.15 p.m., 29½° C.—Very cloudy.
4.45 p.m., 30½° C.—Sunshine for about twenty minutes.
5.15 p.m., 28° C.— } Sun completely obscured.
5.45 p.m., 26° C.— }

From this table there may be seen that the sun was often prevented from making his appearance, by clouds passing by. The day was free from rain, the air was dry, and a southerly breeze was blowing during the time of the experiment.

The result was: the blood exposed to desiccation in this manner proved infectious after one, two, six, and eight hours' exposure (when the experiment was terminated). The rabbits inoculated succumbed to "chicken-cholera" in, respectively, twenty-one, twenty, between thirty and forty, and twenty-eight hours after inoculation. But strange to say, the silk-thread inoculated after four hours' exposure proved inefficacious in so far as the rabbit was still alive, December 17th, ten days after inoculation. It died at about 5.30 p.m., December 18th. *Post-mortem* examination *negative* with regard to "chicken-cholera."

On the other hand, the silk-threads steeped in broth-culture, exposed in exactly the same way, soon lost their efficacy. It was only the first time, after one hour's exposure of the silk-threads, that the inoculation of such a thread proved fatal to a rabbit. It died of undoubted "chicken-cholera" between fifty-nine and sixty-nine hours after inoculation. In all the remaining cases, two and more hours after the beginning of the experiment, the rabbits did not become infected.

From the results thus obtained we learn again that desiccation in general is fatal to the microbes of chicken-cholera. The higher the temperature during the process of desiccation, the less time is required to destroy their virulence.

Desiccation of virulent blood lying on, or impregnating small objects such as the silk-threads used, caused the virus to die off less quickly than is the case with virulent broth-cultures exposed to desiccation under the same circumstances. The reason for this probably is that the superficial portions of the blood drying up, are able to protect the deeper portions for a longer time than is the case with broth-cultures attached to, or saturating small objects, where, by virtue of the composition of the broth, less protection can be afforded to the deeper portions by the superficial ones.

The fact that a virulent broth-culture of the microbes of chicken-cholera very soon ceases to be efficacious when exposed, in a thin layer, to desiccation at summer temperatures such as they exist here, must, in my opinion, to a large extent account for the surviving, now and then, of wild rabbits, which during summer months were given (in shaded hutches) cabbage- or barley-leaves sprinkled with small portions of such a culture, but which were very slow in beginning to eat the infected food, or in finishing it up, so that meanwhile the liquid spread on it was enabled to dry up.

Effect of Putrefaction.

It is ascertained that the bacteria of chicken-cholera, when kept together with other micro-organisms, as in contaminated cultures, are sometimes able to retain their vitality, and power of infecting, for a considerable time, up to three months.*

For my own part, I have tested how long chicken-cholera bacteria would remain active in rabbit-blood which, containing

*Kitt, Wert und Unwert der Schutzimpfungen gegen Tierseuchen Berlin, 1886, p. 55.

the organisms in their full virulence, was allowed to putrefy at a moderate temperature. From the obtained results it follows that in putrefying or putrid blood of the above kind, they may be found still efficacious after weeks.

1888.

At the examination, on the 2nd September, of a rabbit about four days after its death from "chicken-cholera," in one of the burrows in the large enclosure on the Island, the coagulated blood of the right ventricle of the heart was removed and placed in a small clean, not sterilised, glass-flask which was stoppered and put aside in the laboratory. On microscopical examination on the date mentioned, only the microbes of chicken-cholera were present.

(i) September 3rd, 11.30 a.m.

A half-grown rabbit, *inoculated* with a small platinum-loop full of this blood (not yet putrid), was found dead at 7 a.m. on the 3rd September. *P.M.*, *Positive.*

(ii) September 10th, 5 p.m.

A rabbit, *inoculated* with about the same quantity of the blood (now putrid), was found dead at 8.25 a.m. on the 11th September, having died between 7.15 a.m. and that time (*i.e.*, between 14¼ and 15½ hours after being inoculated). *P.M.*, *Positive.*

(iii) September 17th, 2.10 p.m.

A rabbit, *inoculated* with about the same quantity of the blood (putrid), was found dead at 7.40 a.m. on the 18th September. *P.M.*, *Positive.*

(iv) September 20th, 10.40 a.m.

A rabbit, *inoculated* with about the same quantity of the blood (putrid), was found dead at 5 p.m. on the 22nd September, having died between 1.50 p.m. and that time (*i.e.*, between 51 and 54 hours after inoculation). *P.M.*, *Positive.*

(v) September 24th, 11.10 a.m.

A rabbit, *inoculated* with about the same quantity of blood, remained alive after this treatment.

APPENDIX I.

Note on the Transition of Pathogenic Bacteria from the Mother to the Fœtus.

Several pathogenic micro-organisms, especially those which cause lesions of the vascular system (hæmorrhages, thromboses) in the different organs [*e.g. Bacillus anthracis*; *Streptococcus septicus* (Flügge)], are known to be able to pass from the mother to the fœtus. Fraenkel's *pneumococcus* is also capable of so doing; in tuberculosis a passage of the bacillus through the *placenta* appears to exist, but rarely occurs, it is said. In typhoid fever the possibility of a transmission of the bacillus of this disease from the mother to the child has lately been established (J. C. Eberth).*

With regard to chicken-cholera, Marchiafava and Celli found the bacteria of this disease in the fœtus of a guinea-pig which had been successfully infected with those microbes.

On pp. 569, 570, I have given notice of an experiment on guinea-pigs, which were fed on cabbage-leaves sprinkled with virulent chicken-cholera microbes. One of two guinea-pigs which subsequently died from "chicken-cholera," namely a full-grown doe, had in the right uterus a fœtus measuring 53 mm. in a straight line from the vertex of the head to the root of the tail. I will repeat here that the hæmorrhage in the small intestine of the mother animal was less considerable and less marked than in the case of the other younger doe which also died.

Samples of heart-blood and of liver-substance were carefully derived from the above fœtus, and cover-glass preparations made. These were fixed, stained, and examined with homogeneous im-

* *Centralblatt für Bakteriologie und Parasitenkunde.* Band V., No. 19, 1889, pp. 643, 644. See also E. Malvoz, Le passage des micro-organisms au fœtus. Revue critique. *Annales de l'Institut Pasteur.* Tome III., No. 4, 1889, pp. 188-193.

mersion objective, as usual, but there was neither a sign of chicken-cholera bacteria nor of any others. By that, however, it cannot be asserted that the blood of the fœtus must have been absolutely free from such bacteria, because culture-experiments, which would have been decisive, were not carried out.

In rabbits also, the results obtained from a few similar microscopical examinations were negative. Examined were (1) heart-blood of two out of seven fully-developed fœtuses which had been dropped by a doe dead from inoculated "chicken-cholera." In this case, however, the young ones might have been born soon after the inoculation of the mother-rabbit took place. (2) liver-substance of two of several fœtuses contained in the uterus of a doe dead after inoculation; this doe was in the beginning of gestation. (3) liver-substance of one of a few fœtuses taken from the uterus of a doe dead after inoculation; this doe was in about the end of the second week of gestation.

These negative findings, I confess, cannot claim an absolute value from want, again, of any culture-experiments in gelatine being carried out with samples of the fœtal organs; yet they are quite in agreement with the fact that "chicken-cholera" in rabbits, at least in those with which I had to do, presented itself as a rapidly killing septicæmia, in which, if we except the lungs, any visible lesions of the blood-vessels are rarely found.

APPENDIX II.

Remarks on Gamaleia's article "A Contribution to the Etiology of Chicken-cholera, with Notes on the Question of Protective Vaccination."*

In this article Gamaleïa states as the result of direct experiments, which he describes, that microbes of chicken-cholera constantly

* Zur Aetiologie der Hühnercholera. Nebst einigen Bemerkungen über die Schutzimpfungsfrage. Von Dr. N. Gamaleïa, Vicedirector der bakteriologischen Station in Odessa. *Centralblatt für Bakteriologie und Parasitenkunde.* Band IV., 1888, pp. 161-168.

inhabit the normal intestinal canal of pigeons, perhaps also of other birds, similarly as the septic vibrio (the bacillus of malignant œdema) is always present in mammals. In such state the microbes are not virulent enough to do any harm to their host, or to other poultry into which they are inoculated; they are, however, able to cause disease and death in the case of very susceptible, though healthy, animals, namely rabbits and "Ziesel" (also rodents, Genus *Spermophilus*). Transmitted through the body of a rabbit or a "Ziesel," they attain such a strength that they are able to kill pigeons and fowls; on the other hand, fowls can be rendered immune against deadly infection by chicken-cholera bacteria, by means of the inoculation of certain doses of the above virus (passed through rabbits, *e.g.*, from the intestines of healthy pigeons). With regard to the important question: under what conditions the originally harmless bacteria exhibit their dreaded epidemic virulence, Gamaleïa favours the view of the "removal from the intestinal canal of all mesoderm-phagocytes which must be engaged in the digesting of large quantities of the introduced saprophytes." He proposes to strike out the altogether inappropriate designation "bacteria of chicken-cholera," and to substitute the more scientific name "bird-septicæmia." The name for the concerning microbes shall be *coccobacillus avicidus*, which must be assigned to the entosaprophytes which are also facultative parasites.

After having taken information of Gamaleïa's interesting paper I wished to know whether I should succeed in proving the occurrence of attenuated forms of the bacteria of chicken-cholera in normal pigeons, on Australian soil. The tests were made on wild rabbits which throughout were known to me as highly accessible to virulent "chicken-cholera." The results, however, did so far not confirm Gamaleïa's statement; they were all negative, as shown by the following list of experiments. At the end is mentioned the examination of a chick, with the same result.

1888.

(1) September 27th, 3.50 p.m.

A healthy pigeon* was killed by chloroform-narcosis. The contents of the small and large intestines, and part of the contents of the stomach (the latter containing green food) were taken under antiseptic precautions, placed together in a test-tube, and mixed and shaken with about 10 ccm. of sterile distinctly alkaline rabbit-broth. This tube was for a while put in a water-bath at 37° C.

Of this mixture, 1 ccm. was injected subcutaneously into each of two rabbits by means of a sterilised pointed glass-tube.

Results:

(a) One rabbit was found dead at 6 p.m., September 28th. *P.M., Negative.*

A healthy pigeon, inoculated at 10.30 a.m., September 29th, with a platinum-loop full of heart-blood from this rabbit, remained alive and well. A half-grown rabbit, inoculated at 10.45 a.m., same date, with one platinum-loop full, and a full-grown rabbit, inoculated at 11.30 a.m., same day, with five platinum-loops full of heart-blood of the same rabbit, were both alive at 4 p.m., October 8th, when they were removed from their hutch.

(b) The other was still alive at 4 p.m., October 8th, when it was turned loose among others.

(2) October 3rd, 10.40 a.m.

A healthy pigeon was killed by chloroform-narcosis. The contents of the intestines were collected under antiseptic precautions, mixed and shaken with sterile rabbit-broth (as above) in a test-tube, and warmed as before.

Of this mixture injections were made (analogously to the first experiment) into two rabbits. At 11.10 a.m.,

A half-grown rabbit received ½ ccm. of the mixture,

A full-grown rabbit received 1 ccm. of the mixture.

Results:

Both of these rabbits were alive at 9 a.m., October 11th, when they were removed from their hutch.

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* All the pigeons mentioned here were among a consignment of twelve purchased at the Sydney Markets.

(3) November 23rd, 5 p.m.

One of two pigeons, taken out of a consignment of twelve obtained from the Sydney markets, on 8th November—the remaining ten were with two others placed in an aviary, where they were used for another experiment—was killed by chloroform-narcosis. The contents of the intestines, including a portion of the contents of the stomach, were derived under proper precautions, and thoroughly mixed and shaken with about 10 ccm. of sterile distinctly alkaline rabbit-broth in a test-tube.

(*a*) Of this mixture, 1 ccm. each was injected into a full-grown and a half-grown rabbit soon afterwards.

Results :

The half-grown rabbit observed lying dead at 7.30 a.m., November 29th. *P.M.*, *Negative* (both as regards appearance of organs and microscopical examination of liver-blood).

The full-grown rabbit being still alive at 10 a.m., December 2nd, was removed from its hutch.

(*b*) The above mixture was, after the 2 ccm. had been taken out, put into a thermostat where it remained for about 24 hours at about 39° C.

November 24th, 5.30 p.m.

A full-grown rabbit received $\frac{1}{4}$ ccm. = 4 minims,

A half-grown rabbit received $\frac{1}{8}$ ccm. = 2 minims

of the culture obtained from the mixture.

Results :

The full-grown rabbit died at 11.30 a.m., November 30th. *P.M.*, *Negative.*

The half-grown rabbit observed to die at 7.30 a.m., November 25th. *P.M.*, *Negative.*

(4) December 11th, noon.

The remaining of the two pigeons was killed by chloroform-narcosis. About half the contents of the intestines, including part of the contents of the stomach, were transferred to a spacious test-tube containing about 15 ccm. of sterile rabbit-broth which was of a distinctly alkaline reaction.

The mixture after being well-shaken showed still a slightly alkaline reaction. The tube was at once placed in the thermostat at 38° C. to $38\frac{3}{4}$° C., for about twenty-four hours.

December 12th, 1 p.m.—Of the culture obtained (showing now a slightly acid reaction), a very vigorous full-grown doe received (subcutaneously) 1 ccm.; a rabbit not quite full-grown, ½ ccm.

Results:

Both rabbits were alive for a considerable time.

They both died in succession, the following month (January, 1889), but not from "chicken-cholera," or anything similar.

(5) September 14th, 11.30 a.m.

A half-grown rabbit was inoculated with a portion of the contents of the intestines of a young chick sent to me the previous day (dead) from Burwood, near Sydney. (The mortality amongst chickens there had been very great that year, according to information.) The rabbit died between 11 a.m. and 12.30 p.m., September 15th, but on examination it was found that the cause of death could not have been an infection by chicken-cholera microbes. (Another half-grown rabbit was inoculated, at the above date, with heart-blood from the same chick; it also died about a day afterwards, the result of the autopsy likewise excluding "chicken-cholera.")*

* In connection with the above subject it may not be uninteresting to mention that up to the present, chicken-cholera, so devastating and dreaded a disease in other countries, has not been proved to exist in Australasia. I mean, of course, the typical disease with its well-characterised microbes, and not other disorders met with in poultry, where, misled by certain suspicious symptoms, one may think of the true cholera (poultry-typhoid). The Rabbit Commission received specimens of dead fowls or blood from such, mostly from New South Wales, twice from Victoria, and once from New Zealand, in all nine cases. They were examined by me; inoculations were made into fowls (six times), mice (once), rabbits (once), besides mostly examining microscopically the blood, or obtaining in nutrient gelatine colonies of the bacteria present in the suspicious specimens. However, the results showed that bacteria of chicken-cholera were not there. It is to be regretted that at the time of these examinations, rabbits which are susceptible to attenuated "chicken-cholera" (according to Gamaleïa), were not at my disposal, except in one case [(5) above]. Further researches in this direction may ultimately lead to positive results.

TABLE I.

Table of Temperatures, both in air (shaded), and underground (bottom of special small burrow or trench without entrance ; in other respects similar to the proper burrows), in enclosure. General remarks on the weather are found in the last column.

Date. 1888.	In air (shaded), or underground.	Temperatures (°C.) at 7 a.m.	11 a.m.	3 p.m.	7 p.m.	10.30 p.m.	General remarks on the weather.
November 7th.	Air...............			19½	17½	16½	Noon : cool S. breeze. Calm in afternoon, until night.
	Underground			21¼	20½	19¾	
,, 8th.	Air...............	16	19½	19	16½	16¼	Few light showers during last night. 7.30 a.m.: cold S. breeze; fine. 11 a.m.: light breeze; fine. Light S. breeze all afternoon. Evening calm.
	Underground	19½	20	20¾	20	19½	
,, 9th.	Air...............	17¾	24½	20½	17¾	17	Calm all day. Light E. breeze afternoon.
	Underground	19¼	20	21¼	20¾	19¾	
,, 10th.	Air...............	21¾	25¼	22½	20½	18½	7.30 a.m. : calm. Light E. breeze morning. Slight showers 1.30 p.m. to 2.10 p.m. Calm afternoon and evening.
	Underground	19½	21	21¼	21	21	
,, 11th.	Air...............	18¾	24½	23	19¼	17½	Calm morning. Strong E. wind afternoon. Calm evening.
	Underground	19¼	21¼	21½	21½	21¼	

TABLE I.—(*Continued*).

Date. 1888.	In air (shaded), or underground.	Temperatures (°C.) at 7 a.m.	11 a.m.	3 p.m.	7 p.m.	10.30 p.m.	General remarks on the weather.
Novemb. 12th.	Air............ Underground	21 20¼	25¼ 21½	25 22	24 22	18¼ 21½	Calm morning. E. wind most of afternoon. Calm evening.
" 13th.	Air............ Underground	23½ 20¾	28 21½	29½ 22	25 24	18¼ 22	Strong N.W. wind blowing all morning and most of afternoon. Calm evening.
" 14th.	Air............ Underground	21½ 21½	27¾ 21½	26 23¼	22 22¼	19¾ 21¼	Light E. breeze morning. Afternoon and evening calm.
" 15th.	Air............ Underground	26¼ 21½	28¼ 21¾	32½ 24	21¾ 22¾	20 22¼	N.W. wind all morning and afternoon.
" 16th.	Air............ Underground	19¾ 21¾	19 21½	18¼ 21¾	16 21¼	17¼ 20½	Calm, dull, sky overcast. Few drops of rain 6.30 a.m. 9.35 to 10 a.m.: light showers, calm. Noon: light E. breeze, dull. 3 p.m.: calm, dull. Light drizzling rain from 6 p.m. to about 7.15 p.m. Thereafter calm, sky cloudy.
" 17th.	Air............ Underground	19 20½	21½ 20¾	22½ 21¼	20½ 21	20 20¾	Morning: sky overcast, light E. breeze. Afternoon: E. wind. Evening calm.
" 18th.	Air............ Underground	19½ 19½		22¼ 20¾	18½ 21¾	18 20¼	Light S.E. breeze until 11 a.m. S E. wind until night. Calm night.
" 19th.	Air............ Underground	17½ 20½	19⅓ 21	19½ 21½	17 21½	15¼ 20¾	Calm and dull all day.

TABLE I.—(*Continued*).

Novemb. 20th.	Air............ Underground	17¾ 20¼	20¾ 21	21 22	18⅓ 21¾	18 21	Calm, sky overcast until noon. Bright—N.E. breeze—afternoon. Calm night.
,, 21st.	Air.............. Underground	18¾ 20¼	26 21½	23¼ 23½	19¼ 22	17¼ 21	7 a.m.: calm. sky overcast. Bright, with N.E. wind, morning and afternoon. Calm night.
,, 22nd.	Air.............. Underground	19 19½	27 23	26¼ 25	21¼ 23½	18¼ 23½	7 a.m. : calm. N.E. breeze morning and afternoon. Calm night, sky overcast.
,, 23rd.	Air.............. Underground	18 20¼	29½ 23	29¼ 22½	24 22	21¼ 22	Bright — N.E. breeze — morning and afternoon. Night calm, sky overcast.
,, 24th.	Air.............. Underground	20¼ 20½	32½* 23	31¼ 25¼	22¼ 25	20½ 22¾	7 a.m.: calm. 8 a.m.: extraordinarily muggy and misty till 5.30 p.m., when strong S. wind till 7.30 p.m. Night calm, sky overcast.
,, 25th.	Air.............. Underground	19¾ 21	21¼ 22¾	21 23½	18½ 23¼	16¼ 23¼	Bright—varying N.E. and S.W. breezes—morning and afternoon. Night calm, sky overcast.
,, 26th.	Air.............. Underground	19 23	21¾ 23¾	24⅓ 23¾	20½ 23	20¼ 22½	Calm and dull all morning. Bright with N.E. breeze, afternoon. Night calm, sky overcast.
,, 27th.	Air............ Underground	22¾ 22¼	27¼ 24¼	26⅓ 25¾	23¼ 24¾	22 24¼	Morning: bright; N.E. breeze. Afternoon dull and calm. Night: sky overcast; rain, 9·30 to 10 p.m.
,, 28th.	Air.............. Underground	23 23	28¾ 24½	27¾ 26	22½ 24¼	20½ 23½	7 a.m. : calm and dull. Later : light N.E. breeze. 4 p.m. : gloomy ; S. and S.W. winds. 7 p.m. to 10.30 p.m. : showery.
,, 29th.	Air.............. Underground	21¼ 22¼	22¼ 22½	22 22½	20¾ 21¾		Dull, with S.W. breeze, all morning. Dull, calm evening. Night : raining.

* 11.45 a.m., 34¼ ; 1 p.m., 36¾ (greatest heat).

TABLE II.

TABLE of Temperatures, of air (shaded), of the surface of the soil (not shaded), and underground (bottom of specially made small burrow, as in Table I.), in enclosure. In the last column may be found general remarks on the weather during the course of the experiment.

Date. 1889.	Temperatures (°C.) Air (shaded), Surface of soil, Underground.	At 7 a.m.	11 a.m.	3 p.m.	7 p.m.	10.30 p.m.	General remarks on the weather.
February 12th.	Air.............			28	22¾	21¼	Afternoon: bright, N.E. wind, air dry. Night: calm.
	Surface of soil			32	22½	21	
	Underground			26	26	24	
,, 13th.	Air.............	19	29	29½	24¾	22½	7 a.m.: intensely foggy, air moist. 11 a.m.: bright, calm. 3 p.m.: bright, N.E. wind, air dry. 10.30 p.m.: calm, clear.
	Surface of soil	21	36½	33¼	24	22½	
	Underground	26	26	24	23¾	24	
,, 14th.	Air.............	21	31½	26	23¼	22½	Morning: bright, close, moist. 11 a.m.: N.E. breeze. Afternoon: S. wind, sky overcast. Night: S. breeze, clear.
	Surface of soil	22½	38¼	34½	24¾	23	
	Underground	22½	23	23⅔	24	24½	
,, 15th.	Air..	23	28	26	23¾	22¾	7 a.m.: dull, calm. Later on till evening: N.E. breeze, dull. 7 p.m.: calm, dull. 9 p.m.: W. breeze, thunder and lightning without rain.
	Surface of soil	24½	38¼	31½	24¾	23	
	Underground	23¼	23½	24½	24¼	24¼	
,, 16th.	Air.............	23	25	24½	22	22	7 a.m.: S. and S.E. winds, cloudy. Afternoon: S. and S.E. breezes, cloudy.
	Surface of soil	24	32¾	29½	23¼	22¾	
	Underground	23½	24	24¼	24¼	24	
,, 17th.	Air.............	23½	28	24⅔	22½	21¾	Morning: bright. 3 p.m.: dull. Night: sky overcast. N.E. breeze all day.
	Surface of soil	25½	38¼	27¼	23¼	22¾	
	Underground	24	24¼	24¼	24¼	23¾	

TABLE II.—*(Continued)*.

February 18th.	Air...............	21½	30	30	24½	23	7 a.m.: calm, dull. Morning and evening: N.E. breeze, bright, but close. Night: calm, clear.
	Surface of soil	23	40	36	25	23½	
	Underground	23½	24	25	25	25¼	
,, 19th.	Air...............	22	22	21½	20¾	20½	7 a.m.: N.E. breeze, misty. Later: S. and S.E. breezes, sky overcast.
	Surface of soil	22½	24¾	24¼	21½	21¼	
	Underground	24	24	24	23½	23½	
,, 20th.	Air...............	18¾	21¾	22¾	21	21	All day: calm, sky overcast.
	Surface of soil	20½	23½	26	21¾	21½	
	Underground	23	23½	23½	23¼	23¼	
,, 21st.	Air...............	19½	25	27½	24	22¾	7 a.m.: calm, hazy. Noon: N.E. wind; bright, clear. Night: calm, sky overcast..
	Surface of soil	21¾	28¼	34½	24	23	
	Underground	23	23	24	24¼	24¼	
,, 22nd.	Air...............	22	34¼	24	23½	22	All day: very calm, close, and oppressive. Afternoon: about 1½ hour's rain, with thunder. Night: calm, sky overcast.
	Surface of soil	24	41	24½	23½	22	
	Underground	23½	24	24⅜	24¾	24¾	
,, 23rd.	Air...............	22	22½	27	22¾	22	7 a.m.: N.E. breeze, sky overcast. 11 a.m.: light S. breeze. 3 p.m.: light N.E. breeze, bright. 7 p.m.: N.E. breeze, sky overcast. 10.30 p.m.: calm, sky overcast.
	Surface of soil	22	24	30½	23	22	
	Underground	24	23½	24	24¼	24¼	
,, 24th.	Air	22½	29¼	32¼	28½	25¼	7 a.m.: calm, sky overcast. Later: N.E. breeze, bright. Sultry all day and night.
	Surface of soil	23¼	39	40	27½	24¼	
	Underground	23½	24	25	25¼	25¼	
,, 25th.	Air...............	22¼	24¾	25	22	21¾	Morning and evening: S. and S.E. breezes, bright. Night: S. breeze, sky overcast.
	Surface of soil	23	34½	32¼	23¼	23	
	Underground	24½	24½	25	25	24¾	

TABLE II.—(*Continued*).

Date. 1889.	Temperatures (°C.) Air (shaded), Surface of soil, Underground.	At 7 a.m.	11 a.m.	3 p.m.	7 p.m.	10.30 p.m.	General remarks on the weather.
February 26th.	Air..............	21¼	28	27¾	25	24½	7 a.m.: calm. 11 a.m.: N.E. breeze. 3 p.m.: strong N.E. wind, bright all day. 7 p.m.: light N.E. wind, threatening. Night: some thunder and lightning, close.
	Surface of soil	22½	35½	33¼	25½	24¾	
	Underground	24	24	25	25	25¼	
,, 27th.	Air..............	23½	33	38	29¼	27½	Morning: calm, oppressive. Later: N., N.W. and W. winds. Afternoon and night: calm, oppressive, a few drops of rain.
	Surface of soil	24½	36½	37¼	28½	26½	
	Underground	24¼	25.	26	26	26	
,, 28th.	Air..............	20¾	22¼	21	20½	19½	7 a.m.: S. breeze, drizzling rain. Later: S. wind, cloudy.
	Surface of soil	21½	27	24	21½	21	
	Underground	24	24¾	25	25	25½	
March 1st.	Air..............	19¾	21¾	21	20	19	Morning: S. and S.E. breezes. Afternoon: calm, 7 p.m: S. breeze. 10.30 p.m.: rain. Sky overcast all day.
	Surface of soil	20	24	23¼	21½	19½	
	Underground	23	23½	23½	23¼	23¼	
,, 2nd.	Air............	19	24¾	24¾	22¼	22	7 a.m.: calm, sky overcast. Later: N.E. breeze, bright. 7 p.m.: few drops of rain. 10.30 p.m.: calm, damp.
	Surface of soil	20	29½	28½	22	21⅓	
	Underground	22¾	23	23¾	24	23⅓	
,, 3rd.	Air	21	25¾	27¼	23¼	21½	Morning: calm, bright. Afternoon: N.E. breeze, bright. Night: calm, sky overcast.
	Surface of soil	21¼	32	33⅔	23¼	21⅓	
	Underground	23	23½	24½	24½	24	
,, 4th.	Air..............	20½	27¼	28½	24	23¼	7 a.m.: calm, intensely hazy. Later: N.E. wind, bright. Night: calm, sky overcast.
	Surface of soil	22⅔	33¾	34	23½	23½	
	Underground	23½	24	25	25	24¾	
,, 5th.	Air..............	22	29¾	28½			7 a.m.: calm, bright. Later: strong N.E. wind, bright.
	Surface of soil	22¼	40	34½			
	Underground	24	24⅓	25			

TABLE III.

Table showing Results of the Inoculation Series.

Series.	Distinctive number of rabbit.	Inoculated from	Inoculation. Date and time.	Inoculation. Time from death of rabbit in the preceding Series. From time of death.	Inoculation. Time from death of rabbit in the preceding Series. From time of being found dead.	When seen to die, or when found dead.	Time from inoculation to death. When seen to die.	Time from inoculation to death. When found dead. Between	Temperature of body when found dead (centigrade).	Remarks.
			1888.	H.M.	H.M.		H.M.	H.M. H.M.		
I	1	A pigeon that died of chicken-cholera.	Oct. 4th, 11.30 a.m.			Oct. 4th, 9.40 p.m.		9.25 and 10.10		
	2		Oct. 4th, 11.35 a.m.			Oct. 5th, 5.40 a.m.		12.25 „ 18.5	38·45	
II	3	The first rabbit of the preceding Series.	Oct. 4th, 10·15 p.m.		35	Oct. 5th, 1.5 p.m.		14.10 „ 14.50		
	4		Oct. 4th, 10.10 p.m.		30	Oct. 5th, 4.30 p.m.	18.20			
III	5	„	Oct. 5th, 2.15 p.m.		1.10	Oct. 6th, 5 a.m.		12.0 „ 14.50		
	6		Oct. 5th, 2.5 p.m.		1.0	Oct. 6th, 7.50 a.m.		15.40 „ 17.45		
IV	7	„	Oct. 6th, 5.35 a.m.		35	Oct. 6th, 6.50 p.m.	13.15			
	8		Oct. 6th, 5.25 a.m.		25	Oct. 6th, 8.40 p.m.	15.15			
V	9	„	Oct. 6th, 8.15 p.m.	1.25		Oct. 7th, 9.10 a.m.	12.55			
	10		Oct. 6th, 8.5 p.m.	1.15		Oct. 7th, 9.5 a.m.	13.0			
VI	11	„	Oct. 7th, 10.47 a.m.	1.37		Oct. 8th, 12.25 a.m.	13.38			
	12		Oct. 7th, 10.40 a.m.	1.30		Oct. 8th, 12.42 a.m.	14.2			
VII	13	„	Oct. 8th, 1.16 a.m.	51		Oct. 8th, 4 p.m.	14.44			
	14		Oct. 8th, 1.30 a.m.	1.5		Oct. 8th, 8.55 p.m.	19.25			
VIII	15	„	Oct. 8th, 4.57 p.m.	57		Oct. 9th, 6.55 a.m.		13.8 „ 13.58		
	16		Oct. 8th, 5.5 p.m.	1.5		Oct. 9th, 9.27 a.m.	16.22			
IX	17	„	Oct. 9th, 8.15 a.m.		1.20	Oct. 9th, 7.20 p.m.	11.5			No. 17.—Somewhat smaller specimen than usual. Seat of inoculation showing larger area of hæmorrhagic gelatinous œdema than usual. In the liver a few coccidium abscesses.
	18		Oct. 9th, 8.22 a.m.		1.27	Oct. 9th, 11.31 p.m.	15.9			
X	19	„	Oct. 9th, 8.38 p.m.	1.18		Oct. 10th, 9.10 a.m.		11.47 „ 12.32	37·1	No. 19.—A few coccidium abscesses in the liver.
	20		Oct. 9th, 8.30 p.m.	1.10		Oct. 10th, 11.45 a.m.		14.45 „ 15.15		
XI	21	„	Oct. 10th, 10.26 a.m.		1.16	Oct. 10th, 7.55 p.m.		7.29 „ 9.29	38·0	No. 21.—Specimen only about three-quarters grown; rather thin. Few coccidium abscesses in the liver.
	22		Oct. 10th, 10.34 a.m.		1.24	Oct. 11th, 12.55 a.m.	14.21			
XII	23	„	Oct. 10th, 8.55 p.m.		1.0	Oct. 11th, 8.25 a.m.		10.5 „ 11.30	39·8	
	24		Oct. 10th, 9.7 p.m.		1.12	Oct. 11th, 1.35 p.m.		16.3 „ 16.28	40·3	
XIII	25	„	Oct. 11th, 10.8 a.m.		1.43	Oct. 11th, 11.43 p.m.	13.35			
	26		Oct. 11th, 9.58 a.m.		1.33	Oct. 11th, 12.47 a.m.		14.42 „ 14.49	38·6	
XIV	27	„	Oct. 12th, 12.46 a.m.	1.3		Oct. 12th, 6.32 p.m.		17.37 „ 17.46		
	28		Oct. 12th, 12.39 a.m.	56		Oct. 12th, 9.13 p.m.		19.41 „ 20.34	40·45	
XV	29	„	Oct. 12th, 7.40 p.m.		1.8	Oct. 13th, 5.57 a.m.	10.17			No. 29.—A doe which had dropped seven fully-developed young, some of which were found alive the next morning.
	30		Oct. 12th, 7.53 p.m.		1.21	Oct. 13th, 9.15 a.m.		12.37 „ 13.22		
XVI	31	„	Oct. 13th, 8.15 a.m.	2.18		Oct. 13th, 11.56 p.m.	15.41			No. 31.—A doe in the beginning of gestation.
	32		Oct. 13th, 8.7 a.m.	2.10		Oct. 14th, 12.45 a.m.		15.49 „ 16.38		
XVII	33	„	Oct. 14th, 1.10 a.m.	1.14		Oct. 14th, 11.37 a.m.		10.10 „ 10.27		
	34		Oct. 14th, 1.20 a.m.	1.24		Oct. 16th, 1.55 a.m.		45.20 „ 48.35	37·4	No. 34.—A doe, about which something more on page 518.
XVIII	35	„	Oct. 14th, 12.54 p.m.		1.17	Oct. 15th, 12.30 a.m.		11.20 „ 11.45	41·7	
	36		Oct. 14th, 12.45 p.m.		1.8	Oct. 15th, 1.55 a.m.	13.10			
XIX	37	„	Oct. 15th, 1.41 a.m.		1.11	Oct. 15th, 4.38 p.m.	14.57			
	38		Oct. 15th, 1.32 a.m.		1.2	Oct. 15th, 6.50 p.m.		16.33 „ 17.18		No. 38.—A doe in about the end of the second week of gestation.
XX	39	„	Oct. 15th, 5.45 p.m.	1.7		Oct. 16th, 7.5 a.m.		9.25 „ 13.20	35·6	
	40		Oct. 15th, 5.38 p.m.	1.0		Oct. 16th, 7.20 a.m.	13.42			

TABLE IV.

TABLE showing results of inoculation of fowls and pigeons with the virus of chicken-cholera, taken from certain cases out of the Inoculation Series of Rabbits (Table III).

Series.	Fowl or pigeon.	Inoculated from virulent blood of rabbit of	Inoculation. Date and time.	Time from death of rabbit to inoculation of fowl or pigeon. From time of death.	From time of being found dead.	When seen to die, or when found dead.	Time from inoculation to death. When seen to die.	When found dead. Between		Remarks.
			1888.	H. M.	H. M.		H. M.	H. M.	H. M.	
I	Fowl	Inoculation Series I.	Oct. 16th, 2.40 a.m.		45*	Oct. 16th, 11.30 p.m.	20.50	17.25 and	18.30	*Body when found was cold. Fowl must have died between 12 h. 30 m. and 15 h. 45 m. after inoculation.
	Pigeon		,, 2.50 a.m.		55	,, 9.20 p.m.				
II	Fowl	Inoculation Series V.	Oct. 7th, 11 a.m.	1.50		Oct. 8th, 7.35 a.m.		14.30 ,,	20.35	
	Pigeon		,, 10.52 a.m.	1.42		,, 7.35 a.m.		14.38 ,,	20.43	
III	Fowl	Inoculation Series X.	Oct. 10th, 10.45 a.m.		1.35†	Oct. 11th, 8.25 a.m.		20.15 ,,	21.40	† Temperature when found dead 37·1° C. This fowl had laid an egg between 7 a.m. and 8.25 a.m., which appeared perfectly normal as regards both the exterior and interior. On microscopical examination of the yolk, micro-organisms could not be detected.
	Pigeon		,, 10.50 a.m.		1.40	,, 6.50 a.m.		14.15 ,,	20.0	
IV	Fowl	Inoculation Series XV.	Oct. 13th, 8.25 a.m.	2.28		Oct. 14th, 8.30 a.m.		23.20 ,,	24.5	
	Pigeon		,, 8.33 a.m.	2.36		,, 13th, 11.10 p.m.		13.57 ,,	14.37	
V	Fowl	Inoculation Series XX.	Oct. 16th, 10. 5 a.m.		3 .0‡	Oct. 17th, 5.45 a.m.		17.20 ,,	19.40	‡Temperature when found dead 35·6° C.
	Pigeon		,, 10.10 a.m.		3 .5	5.45 a.m.		17.15 ,,	19.35	

TABLE V.

TABLE showing Body Temperatures of certain of the Rabbits used in the Inoculation Series.

Number.	Corresponding Series and Number in Table III. Series.	Number.	Temperatures (Centigrade). At time of inoculation.	Hours after inoculation. 2	2½	3	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	15	Remarks.
1	I	1		39.8			39·9				40·2				40·7				†											
2	,,	2	39·9	39·4			40·7				40·7				40·0				40·95											† Between 12h. 25m. and 18h. 5m. after inoculation.
3	III	5	39·85	39·7				40·0					40·0				40·8						41·0							† Between 12h. and 14h. 50m. after inoculation.
4	,,	6	40·2	40·1				39·65					40·1				40·4						40·25							† Between 15h. 40m. and 17h. 45m. after inoculation.
5	IV	7	40·0					40·35				49·6				41.4				41·47					39·6†					
6	,,	8	39·2					38·8									39·4				39·25					40·6			39·67†	
7	VI	11	38·9	39·07			39·3				39·[illegible]				39·4				40·26					40·8		39·6†				
8	,,	12	39·1	39·6			39·8				40·[illegible]				40·2					41·6				41·6			40·2†			
9	IX	17	38·85			39·2		39·4					39·6				40·4				40·0†									
10	,,	18	39·1			39·2		39·6					39·7				39·9				40·45				40·5				40·9†	
11	XI	21	39·3		38·45				39·5					40·7																Found dead after 9h. 29m., when the body-temperature was 38° C.
12	,,	22	39·8		39·26				38·7					38·7				39·6				39·5						39·6†		
13	XIII	25	39·8	39·4						39·6					39·4					41·4			41·27			41·25†				
14	,,	26	40·1	40·5						40·46					38·9					40·4			40·86							Found dead after 14h. 49m., when the body-temperature was 38·6° C. (Died between 14h. 42m. and 14h. 49m. after inoculation).
15	XVI	32	38·7		39·3				39·15										39·3				39·1							† Between 15h. 49m. and 18h. 38m. after inoculation.
16	XVIII	35	39·9		39·6				40·05					40·4				41·2				41·7†								
17	,,	36	39·8		39·4				39·8					39·2				39·6							40·2†					
18	XX	39	39·6		38·8				39·7										40·2											
19	,,	40	40·0		39·4				39·1										39·5							38·4†				Found dead 13h. 20m. after inoculation Body-temperature was then 35·6° C.

NOTE.—Wherever the symbol † is used in this Table, it means "died."

TABLE VI. (*a*).

Showing results of experiments (by feeding) on indigenous Birds.

Names of birds.	Date and time of feeding.	Infected food as placed in each cage. Description.	Quantity.	Results.	Remarks.
Two Wekas ... ... (in one cage).	1888. Oct. 12th, 11.5 a.m.	Liver and heart-blood from rabbit No. 22 of Inoculation Series XI., Table III.	10g.	Both were still alive on October 19th	They ate all the food at once.
Two Magpies ... (in one cage).	„ 11.10 a.m.	ditto ditto ditto	10g.	One was found dead at 6.35 a.m. on October 13th (*i.e.*, between 18h. 50m. and 19h. 25m. after being fed). *P.M.*, *Positive*. The other was found dead at 1 p.m. on the same day (*i.e.*, between 25h. 25m. and 25h. 50m. after being fed). *P.M.*, *Positive*.	They ate all the food at once.
Two Laughing Jackasses. (in one cage).	„ 11.15 a.m.	ditto ditto ditto	10g.	One was found dead at 3.5 p.m. on October 17th (*i.e.*, between 122h. 45m. and 124h. 50m. after being fed). *P.M.*, *Negative*. The other was still alive on October 19th.	They had eaten all the food in five minutes.
Two Butcher-birds and one Blue Jay. (in one cage).	„ 11.20 a.m.	ditto ditto ditto	10g.	One Butcher-bird was found dead at 6 a.m. on October 13th (*i.e.*, between 10h. 30m. and 18h. 40m. after being fed). *P.M.*, *Positive*. The other Butcher-bird was found dead at 9.20 a.m. on the same day (*i.e.*, between 21h. 10m. and 22h. after being fed). *P.M.*, *Positive*. The Blue Jay was found dead at 2.10 p.m. on the same day (*i.e.*, between 26h. 30m. and 26h. 50m. after being fed). *P.M.*, *Positive*.	They had eaten all the food in a quarter of an hour.
Two Gallahs ... ... (in one cage).	„ noon	ditto ditto ditto, (mixed with 0·6 p.c. salt-solution and mashed up with crushed maize).	1g. (excl. of salt-solution and maize).	One was found dead at 7.30 a.m. on October 14th (*i.e.*, between 37h. and 43h. 30m. after being fed). *P.M.*, *Positive*. The other was still alive on October 19th.	They had eaten about half in 2½ hours, and in 5 hours had eaten all.
Two Wonga Pigeons and one Bronze-wing Pigeon. (in one cage).	„ 12.20 p.m.	ditto ditto ditto	1½g. (as before).	One Wonga Pigeon was found dead at 12.48 a.m. on October 14th (*i.e.*, between 35h. 30m. and 36h. 28m. after being fed). *P.M.*, *Positive*. The Bronze-wing Pigeon was found dead at 12.30 p.m. on October 13th (*i.e.*, between 23h. 10m. and 24h. 10m. after being fed). *P.M.*, *Positive*. The other Wonga Pigeon was still alive on October 19th.	They had eaten about half in 2 hours, and in 4½ hours had eaten all.
Two Quail ... ... (in one cage).	„ 12.25 p.m.	ditto ditto ditto (a similar mixture mashed up with bread-crumbs).	½g. (cf. above).	One was found dead at 6 a.m. on October 13th (*i.e.*, between 9h. 30m. and 17h. 35m. after being fed). *P.M.*, *Positive*. The other was still alive on October 19th.	They had eaten all in an hour.

Controls: A full-grown rabbit, fed upon cabbage-leaves infected with 1 g. of the same material as above (infusion in 0·6 p.c. salt-solution), died 33h. 50m. after being fed. *P.M.*, *Positive*.
A half-grown rabbit, fed upon cabbage-leaves infected with ½ g. contained in a similar infusion, died between 37h. and 42h. 50m. after being fed. *P.M.*, *Positive*.

TABLE VI. (b).

SHOWING results of further experiments (by feeding and inoculation) on the indigenous Birds surviving from the experiments, as detailed in Table VI. (a).

Names of birds.	Date and time of treatment.	Nature of treatment.	Quantity of the material used.	Results.	Remarks.
Two Wekas (kept, after treatment, in one cage).	Oct. 19th, 9.45 a.m. ,, 10.10 a.m.	One was inoculated with liver-blood from rabbit No. 34, Inoculation Series XVII., Table III. The other was fed upon liver from the same rabbit.	1 platinum loopfull (about 1-200th ccm.) 10g.	Both were still alive on October 29th.	The one which was fed (separately from the inoculated one), ate all at once.
One Laughing Jackass	,, 10.20 a.m.	Fed on the same material...	$7\frac{1}{2}$g.	Was still alive on October 29th.	In half-an-hour it had eaten all except a small piece, and in $3\frac{1}{2}$ hours it had eaten all.
One Wonga Pigeon ...	,, 10.40 a.m.	Ditto ditto ditto (mixed with 0·6 p.c. salt-solution and mashed up with crushed maize).	1g. (excl. of salt-solution and maize).	Was found dead at 7.15 a.m. on October 22nd (*i.e.*, between 59h. 20m. and 68h. 35m. after being fed). *P.M.*, *Positive*.	It had eaten all in half-an-hour.
One Gallah	,, 10.50 a.m.	Ditto ditto ditto	1g. (as before).	Was still alive on October 29th.	In an hour it had eaten more than half, and in $3\frac{1}{2}$ hours it had eaten all.
One Quail	,, 10.55 a.m.	Ditto ditto ditto (a similar mixture mashed up with bread-crumbs).	$\frac{1}{2}$g. (cf. above).	Was found dead at 12.25 p.m. on October 20th (*i.e.*, between 25h. 5m. and 25h. 30m. after being fed). *P.M.*, *Positive*.	In an hour it had eaten nearly all, and in 2 hours had finished all.

Controls: (*a*). Two half-grown rabbits, in one hutch, were fed upon cabbage-leaves infected with $1\frac{1}{2}$g. of the same material as above (infusion in 0·6 p.c. salt-solution) for the two. *One* died between 22h. 45m. and 24h. 40m. after being fed. *P.M.*, *Positive*. The other died between 94h. 25m. and 98h. 35m. after being fed. *P.M.*, *Negative*.
(*b*). A half-grown rabbit, inoculated with one platinum loopfull (about 1-200th ccm.) of the liver-blood (as used above), died between 13h. 20m. and 21h. 35m. after being fed. *P.M.*, *Positive*.

TABLE VI. (c).

SHOWING results of further experiments (by inoculation) on the indigenous Birds surviving from the experiments, as detailed in Table VI. (b).

Names of Birds.	Date and time of inoculation.	Inoculation (by way of injection) with	Results.	Remarks.
Two Wekas (in one cage).	Oct. 29th, 10.45 a.m. ,, 10.50 a.m.	1-16th ccm. (1 minim) of heart-blood from a rabbit dead between 9h. 5m. and 17h. 15m. after inoculation with a virulent broth-culture of the microbe of chicken-cholera. ditto ditto ditto	Both remained alive. For further treatment see Table VI. (*d*).	
One Laughing Jackass	,, 10.40 a.m.	ditto ditto ditto	It was found dead at 2.5 p.m. on November 1st (*i.e.*, between 71h. 20m. and 75h. 25m. after inoculation). *P.M.*, *Positive*.	A half-grown rabbit, inoculated with a good platinum loopfull of heart-blood from this jackass, died between 11h. 15m. and 12h. 35m. after inoculation. *P.M.*, *Positive*.
One Gallah	,, 11.5 a.m.	ditto ditto ditto	It was found dead at 7.15 a.m. on October 30th (*i.e.*, between 11h. 40m. and 20h. 10m. after inoculation). *P.M.*, *Positive*.	

Control: A full-grown rabbit inoculated with a like quantity of the same material, died between 11h. 15m. and 19h. 40m. after inoculation. *P.M.*, *Positive*.

TABLE VI. (*d*).

SHOWING result of a further experiment (inoculation) on the indigenous Birds surviving from the experiments, as detailed in Table VI. (*c*).

Name of Birds.	Date and time of inoculation.	Inoculated (by way of injection) with	Results.	Remarks.
Two Wekas (in one pen).	1889. April 8th, about noon.	$\frac{1}{4}$ ccm. (4 minims) of liver-blood from a rabbit newly dead from "chicken-cholera" on inoculation . . . one Weka (hen).	The Weka-hen remained alive for good, being, however, indisposed for the first few days after the treatment. From the place of inoculation necrotised tissue was ejected in due time.	It was not to be decided, which one had been once fed and twice inoculated before, and which one had been twice fed and once inoculated.
		About half that quantity. . . . Other Weka (rooster). [Inoculation of the material, which was to have been as much as in the previous case, being only partly successful].	The Weka-rooster, after conspicuous illness, was found dead at 6.25 a.m., April 10th. *P.M.*, *Negative ?*	A full-grown, vigorous rabbit was inoculated, as control, with $\frac{1}{4}$ ccm. of the liver-blood mentioned. It was found dead at 7 a.m., next morning; it must have died soon after 10 p.m., the previous day. *P.M.*, *Positive.*

TABLE VII.

Showing Results of certain Experiments on Fowls and Pigeons.

(a) First Experiment (feeding).

Fowl or pigeon.	Date and time of feeding.	Description of food.	Quantity.	Results.	Remarks.
Fowl (No. 1) (Rooster)	1888. Oct. 5th, 10.10 a.m.	Bread infected with (coagulated) heart-blood from Rabbit No. 2, Inoculation Series I., Table III.	$\frac{1}{2}$ g. (excl. of bread).	Still alive on Oct. 14. For further treatment *vide* (*b*).	It ate all the food at once.
Fowl (No. 2) (Hen)	Oct. 5th, 10.30 a.m.	Do. do	1 g. (as before).	Do. do.	It had eaten all except a few crumbs in $3\frac{1}{4}$ hours.
Pigeon (No. 1)	Oct. 5th, 10.55 a.m.	Do. do. (mixed with 0·6 p.c. salt-solution and mashed up with crushed maize).	$\frac{1}{2}$ g. (excl. of salt-solution and maize).	Do. do.	The exact time after which this pigeon had eaten, or nearly eaten the food, was not specially noted. It was, however, observed to be very slow in proceeding to eat.
Pigeon (No. 2)	Oct. 5th, 11.10 a.m.	Do do.	$\frac{1}{4}$ g. (as before).	Do. do.	Do. do.

TABLE VII.—*(Continued)*.

(b) SECOND EXPERIMENT (feeding).

Fowl or pigeon.	Date and time of feeding.	Description of food.	Quantity.	Results.	Remarks.
Fowl (No. 1) (Rooster)	Oct. 14th, 11.10 a.m.	Liver from Rabbit No. 31, Inoculation Series XVI., Table III.	5 g.	Still alive on Oct. 19. For further treatment *vide* (*c*).	It ate all the food at once.
Fowl (No. 2) (Hen)	Oct. 14th, 11.15 a.m.	Do. do.	2½ g.	Was found dead at 2 p.m., Oct. 15th. *P.M.*, *Negative.*	Do. do.
Pigeon (No. 1)	Oct. 14th, 11.30 a.m.	Do. do. (mixed with 0·6 p.c. salt-solution and mashed up with crushed maize).	½ g. (excl. of salt-solution and maize).	Still alive on Oct. 29. For further treatment *vide* (*d*).	It had eaten nearly all in 2 hours, and in 5½ hours had eaten all.
Pigeon (No. 2)	Oct. 14th, 11.35 a.m.	Do. do.	½ g. (as before).	Still alive on Oct. 19. For further treatment *vide* (*c*).	It had eaten about half in 2 hours, and in 5½ hours had eaten all.

TABLE VII.—(*Continued*).

(*c*) Third Experiment (feeding).

Fowl or pigeon.	Date and time of feeding.	Description of food.	Quantity.	Results.	Remarks.
Fowl (No. 1) (Rooster)	Oct. 19th, 10.15 a.m.	Liver from Rabbit No. 34, Inoculation Series XVII., Table III.	10 g.	Still alive on Oct. 29. For further treatment *vide* (*d*).	It ate all the food at once.
Pigeon (No. 1)					Not experimented upon this date. For further treatment *vide* (*d*).
Pigeon (No. 2)	Oct. 19th, 11.5 a.m.	Do. do. (mixed with 0·6 p.c salt-solution and mashed up with crushed maize).	1 g. (excl. of salt-solution and maize).	Do. do.	It had eaten very little in 2 hours, and in 3 hours had eaten about half. It was not until the following morning (say after 20 hours) that it was observed to have eaten all.

TABLE VII.—(*Continued*).

(*d*) FOURTH EXPERIMENT (inoculation).

Fowl or pigeon.	Date and time of inoculation.	Inoculated (by way of injection) with—	Results.	Remarks.
Fowl (No. 1) (Rooster)	Oct. 29th, 11.10 a.m.	1-16th ccm. (1 minim) of heart-blood from a rabbit dead between 9h. 5m. and 17h. 15m. after inoculation with a virulent broth-culture of the microbe of chicken-cholera.	Remained alive. For further treatment *vide* (*e*).	
Pigeon (No. 1)	Oct. 29th, 11.20 a.m.	Do. do.	Was found dead at 7.15 a.m., Oct. 30th (*i.e.*, between 11h. 10m. and 19h. 55m. after inoculation). *P.M.*, *Positive.*	
Pigeon (No. 2)	Oct. 29th, 11.30 a.m.	Do. do.	Was found dead at 7.15 a.m., Oct. 30th (*i.e.*, between 11h. and 19h. 45m. after inoculation). *P.M.*, *Positive.*	

(*e*) FIFTH EXPERIMENT (inoculation).

Fowl.	Date and time of inoculation.	Inoculated (by way of injection) with—	Result.	Remarks.
Fowl (No. 1) (Rooster)	1889. April 8th, noon.	¼ ccm. (4 minims) of liver-blood from a rabbit recently dead from "chicken-cholera" after inoculation with virulent gelatine-stick culture of the 11th generation.	Died at 3.15 p.m., April 9th (*i.e.*, 27 hours after inoculation). *P.M.*, *Positive.*	It had been lying some time before death on one side, and breathing with great difficulty. It died under cramps and dyspnœa.

NOTES AND EXHIBITS.

Mr. A. Sidney Olliff exhibited, on behalf of Mr. C. S. Wilkinson, a community of Wasps (*Polistes* sp.) from Drake, near Tenterfield, recently obtained by that gentleman.

Mr. Olliff also showed a selection of insects from a large and interesting series from Mt. Kosciusko, recently obtained on behalf of the Trustees of the Australian Museum by Mr. Helms. Although the collection contains many new forms, particularly among the Coleoptera and Hymenoptera, no peculiar mountain forms which so often characterise the faunas of high altitudes were found; but he thought there were two noteworthy points with regard to the collection, namely, the occurrence of certain distinctly Tasmanian types among the Orthoptera and Coleoptera, and the general similarity of the fauna to that of the higher elevations of the Coast Range.

Mr. Skuse exhibited a large collection of Diptera (numbering about 650 specimens) also obtained by Mr. Helms under circumstances similar to those just mentioned. It contains several new and remarkable forms, among which a new genus of *Tipulidæ longipalpi* with pectinate antennæ is one of the most interesting. The excellent state of preservation of so large a number of minute specimens and the skill displayed in mounting them alike testify to the ability and industry of the collector.

Mr. Helms offered some remarks upon some of the more striking forms in the collections referred to, more particularly the wingless grass-hoppers: and he also alluded to his discovery of *Peripatus* at altitudes up to 5700 feet.

Mr. Rohu exhibited a collection of mounted specimens of English plants, and signified his intention of presenting the collection to the Society's herbarium.

Mr. David exhibited sections and specimens of the kerosene shale and fire-clay referred to in his paper.

Dr. Katz exhibited drawings, and a collection of pure cultures of the microbes of chicken-cholera.

WEDNESDAY, 31st JULY, 1889.

Dr. James C. Cox, Vice-President, in the Chair.

Mr. Reid and Mr. R. Helms were introduced as visitors.

The Chairman announced—

(i) That the next Excursion had been arranged for August 24th, to leave Redfern Station, for Como, Illawarra line, by the 9.10 a.m. train.

(ii) That the next Meeting of the Australasian Association for the Advancement of Science would be held in Melbourne, commencing on 7th January, 1890.

DONATIONS.

"L'Académie Royale de Copenhague.—Bulletin pour 1888." No. 3; "1889." No. 1. *From the Academy.*

"Monatliche Mittheilungen des naturwissenschaftl. Vereins des Reg.-Bez. Frankfurt." Jahrg. VI., Nos. 7-9 (October-December, 1888); "Societatum Litterae." Jahrg. II., Nos. 9 and 10 (September and October, 1888). *From the Society.*

"The Journal of Conchology." Vol. VI., No. 2 (1889). *From the Conchological Society of Great Britain and Ireland.*

"The Canadian Record of Science." Vol. III., No. 6 (1889). *From the Natural History Society of Montreal.*

"Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A." Vol. XVI., No. 4; XVII., No. 3 (1889). *From the Curator.*

"Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft, Frankfurt a. M." XIV. Band, Hefts 2 and 3 (1886); "Bericht, 1886." *From the Society.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 308 and 309 (1889). *From the Editor.*

"The Quarterly Journal of the Geological Society of London." Vol. XLV., Part 2 (No. 178), 1889. *From the Society.*

"Proceedings of the Zoological Society of London for the year 1888." Part IV.; "Abstract of Proceedings," 21st May and 4th June, 1889. *From the Society.*

"Feuille des Jeunes Naturalistes." No. 224 (June, 1889) *From the Editor.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CVIII., Nos. 13-18 (1889). *From the Academy.*

"The Victorian Naturalist." Vol. VI., No. 3 (July, 1889). *From the Field Naturalists' Club of Victoria.*

"Proceedings of the Royal Society of Victoria." New Series Vol. I. (1889). *From the Society.*

"Records of the Geological Survey of India." Vol. XXII., Part 2 (1889). *From the Director.*

"Catalogue of the Lower Silurian Fossils, Cincinnati Group." By U. P. James (1st and 2nd Editions); also 23 Pamphlets on various subjects. *From Professor J. F. James.*

"Tijdschrift voor Entomologie, uitgegeven door de Nederlandsche Entomologische Vereeniging." Deel XXXI. (1887-88). *From the Society.*

"The Proceedings of the Royal Society of Queensland, 1889." Vol. VI., Part 4. *From the Society.*

"Report of Trustees of the Australian Museum for the year 1888." *From the Trustees.*

"Bulletin de la Société Zoologique de France pour l'Année 1889." Tome XIV., No. 4, (April). *From the Society.*

"Bulletin de la Société Impériale des Naturalistes de Moscou." Année 1888, No. 4. *From the Society.*

"British Museum.—Catalogue of Marsupialia and Monotremata." By O. Thomas (1888); "Catalogue of Fossil Cephalopoda. Part i." By A. H. Foord, F.G.S. (1888); "Catalogue of Fossil Fishes. Part i." By A. S. Woodward, F.G.S., &c. (1889); "Catalogue of Chelonians, &c." New Edition. By G. A. Boulenger (1889). *From the Trustees.*

Pamphlet entitled "Sur les Courants Superficiels de l'Atlantique Nord." Par S. A. le Prince Albert de Monaco. *From the Author.*

"Mémoires et Publications de la Société des Sciences des Arts et des Lettres du Hainaut." 5me Série. Tome I. (1889). *From the Society.*

"Journal of the Royal Microscopical Society, London, 1889." Part 3. *From the Society.*

"Reichenbachia.—Orchids Described and Illustrated by F. Sander, &c." Vol. I. (12 parts); II. (parts 1-5), [1888-89]; "A History of British Fossil Reptiles." (4 vols). By Sir Richard Owen, K.C.B., F.R.S., &c. *From Sir William Macleay, F.L.S., &c.*

"The Gold-Fields of Victoria.—Reports of the Mining Registrars for the quarter ended 31st March, 1889." *From the Secretary for Mines, Melbourne.*

Pamphlet entitled "On the Occurrence of Tellurium in New South Wales Ores." By J. C. H. Mingaye, F.C.S. *From the Author.*

Eight Pamphlets on various Biological Subjects. By Professor Ralph Tate, F.G.S., &c. *From the Author.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 43, (July, 1889). *From the Editor.*

DESCRIPTION OF A NEW SPECIES OF *IODIS*, WITH REMARKS ON *PIELUS IMPERIALIS*, OLLIFF.

BY THOMAS P. LUCAS, M.R.C.S., L.S.A., LOND., L.R.C.P., EDIN.

The past season in Brisbane has been most unfavourable for the appearance of Lepidoptera. Many of the new species of *Iodis* I found last year have not turned up at all, and all have been rare. I have found *I. leucomerata* here for the first time. I obtained one worn specimen of a new species early in the year, but must wait for describing until I obtain better specimens. But last April Mr. Illidge was fortunate enough to discover a novel and most interesting species on a small tree growing in his garden, which he had transplanted from the bush. With a lantern light he discovered the imago flying rapidly around the tree, and afterwards Mrs. Illidge found the pupa cases in very light cocoons among the leaves, evidently showing that the larvæ had fed there, and that the moths were there to deposit their eggs. I have great pleasure in naming the species after its discoverer.

IODIS ILLIDGEI, sp.nov.

♂♀. 25-30 mm. Face brown-red, fillet yellow-green, crown green with a very fine white line posteriorly. Palpi greenish-white. Antennæ yellow-green, pectinations of ♂ short, white-green. Thorax pea-green, dorsum posteriorly yellow-green, undersurface white. Abdomen pea-green, dorsum yellow-green, lateral surface posteriorly and undersurface white. Legs white, upper surface of anterior coxæ and tibiæ brownish-white. Forewings, costa nearly straight, rounded towards apex, hindmargin obliquely rounded, pea-green; costal line and hindmarginal line yellow-green: cilia

greenish-white. Hindwings as forewings, hindmarginal line yellow-green; hindmargin slightly angled at vein 4: cilia greenish-white. Undersurface of wings greenish-white.

The light pea-green colour, absence of markings, and the yellow-green borders of wings readily distinguish this species. It comes near to *Urolitha bipunctifera*, Walk., but appears to be a true *Iodis*.

Postscript.—Since writing the above, I find that the tree on which these caterpillars feed is *Duboisia myoporoides*. Dr. Thomas L. Bancroft found the exuvia of a caterpillar, probably a larger species, among a quantity of collected leaves. It contained the active poison principle duboisin. Caterpillar elongated, flattened, green with lighter green and darker green linear stripes laterally.

In the Proceedings of this Society for 1887, (p. 1016, pl. XXXIX.), Mr. Olliff described and figured a moth of the genus *Pielus* belonging to Mr. Prince. I happened to be present at the meeting at which the specimen was exhibited, and stated that I possessed three specimens from the Gippsland District. I had sent an example to Mr. Meyrick, who afterwards returned it named *P. hyalinatus*. On referring to Schäffer's *Lepidopt. Exot. Nov.* Ser. i, fig. 50, I find an almost exact coloured copy of Pl. XXXIX. of P.L.S. N.S.W., and the insect named *P. hyalinatus*. Walker also described it under the name *P. hyalinatus*, and referred to Schäffer; hence Mr. Olliff's name *P. imperialis* must give way to *P. hyalinatus*.

I have a specimen I take to be the ♂. It is 75 mm., and is marked similarly to the larger ones, but the two apical spots alone of the oblique row of spots parallel with the hindmargin of the forewings are silvered.

THE EXAMINATION OF KINOS AS AN AID IN THE DIAGNOSIS OF EUCALYPTS.

PART I.—THE RUBY GROUP.

By J. H. Maiden, F.L.S., F.C.S.

The astringent exudations so common on species of Eucalyptus are termed Kinos. The author is not aware that these substances have hitherto been taken cognisance of in the elucidation of species, and he proposes to give a brief account of his experiments in this direction. The genus Eucalyptus is such an abnormally difficult one, that any method of showing the affinities of its species must be welcome.

The author has already shown (*Pharm. Journ.* [3], XX. p. 221) that Eucalyptus Kinos may readily be grouped into three great classes, according to their behaviour with water and with spirit. Briefly, he divided them into (1) The Ruby Group, which consists of ruby-coloured Kinos, the members of which are soluble either in cold water or in cold spirit; (2) The Gummy Group, whose members are soluble in cold water, but very imperfectly in spirit, owing to the gum they contain; (3) The Turbid Group, whose members are soluble in hot water or in hot alcohol, but the solutions become turbid on cooling; all the members of this group contain catechin.

The author, however, wishes to make it quite clear that these Groups only refer to Kinos which he has actually examined, since he does not presume that the Kinos he has never seen fall into either one of them, whatever his opinion may be in regard to some of those yet undescribed. It is very possible that fresh groups and sub-groups showing affinities of Kinos may yet require to be erected, but the material at his disposal at present does not justify him in making other than the three broad groups already alluded to.

Bentham (following Mueller, *Fragm.* ii.), in the *Flora Australiensis*, classified the Eucalypts according to the shape of their anthers. The Renantheræ, those with kidney-shaped anthers, comprise the following species found in New South Wales :—

E. stellulata, Sieb.
E. pauciflora, Sieb.
E. regnans, F.v.M.
E. amygdalina, Labill.
E. obliqua, L' Hérit.
E. stricta, Sieb.
E. macrorrhyncha, F.v.M.
E. capitellata, Sm.
E. eugenioides, Sieb.
E. piperita, Sm.
E. pilularis, Sm.
E. triantha, Link (Syn. *E. acmenioides*, Schau.)
E. haemastoma, Sm.
E. Sieberiana, F.v.M. (Syn. *E. virgata*, Sieb.)
E. microcorys, F.v.M.

With the exception of that of *E. triantha*, the author has examined the Kinos of all the above species, including those of innumerable individuals belonging to species found in the Counties of Cumberland, Camden and Cook. It is rather remarkable to find that, with one exception *(E. microcorys)*, the whole of the Kinos in the Renantheræ belong to the Ruby Group. The author also has arrived at some unexpected results in connection with the other two groups, but he does not propose to deal with those in the present paper.

E. microcorys has quite an anomalous Kino, that is to say, it can readily be distinguished from all others Unlike the Ruby Kinos it is *very friable* (capable of being crushed to a fine powder between the fingers, which no "ruby" Kino ever is), and looks like a parcel of uncut garnets. It forms an *orange-brown* powder, and belongs to the Turbid Group. At present it may be compared to "the exception which proves the rule." It is, however, worthy of

note that *E. microcorys* is not placed by Bentham in the Renantheræ, but in a group called by him Heterostemones, in which he includes an additional member of Baron Mueller's Renantheræ, the other members falling in the Baron's Porantheræ.

The author has proved by experiments on many samples that a Kino of one species, no matter what its variety, and under whatever circumstances of climate, soil, &c., it may grow, invariably belongs to one group.* For example, all the Kinos of perhaps twelve specimens of eight varieties of *E. amygdalina* Kino which have passed through his hands belong to the Ruby group, and not one to either the Gummy or the Turbid group. The composition of all Kinos appears to be constant to that extent. Since this discovery dawned upon the writer, he has had many opportunities of verifying its truth; in some notable instances where Kino has been forwarded to him, he has been able to call the naming of the species in question, and by assigning the group to which it belongs has thrown light upon its position, and has caused the evidence on which a species-name had been given to be re-opened, with the result, in each case, of alteration. He therefore does not hesitate to strongly recommend that in sending specimens of little known or variable Eucalypts to be named, the *Kino*, wherever procurable, should always form portion of the material for the botanist to work upon.

The author offers his chemical system of grouping Eucalypts merely as a supplement to, or a check upon, the anthereal

* In the amplified anthereal grouping of Bentham, the following species are placed by him in more than one series or sub-series :—

E. virgata (Sieberiana).
E. bicolor (largiflorens).
E. stricta.
E. albens (hemiphloia).
E. siderophloia.
E. gomphocephala.

At the same time, it is but fair to point out that in Baron Mueller's anthereal classification no Eucalypt appears in more than one group, of which, however, there are but three for the whole genus.

system. Often Kino cannot be found on a certain tree; on the other hand, the uncertain period of flowering of many species often precludes any examination of anthers. And when anthers are obtained, only those who have frequently examined the flowers of this genus know how difficult and uncertain it is to assign the species yielding them to its proper anthereal group. When once the Kino is obtained, however, an ordinary child of seven would be able accurately to place it in its proper group.

The specimens of Kino now, and to be, described are the property of the Committee of Management of the Technological Museum, in which collection will be found many specimens collected by Mr. Bäuerlen on behalf of the Committee, over forty specimens collected by the author, together with a few of miscellaneous origin, the whole forming a series probably not to be equalled anywhere.

It will be seen from the descriptions now given how similar are all the Kinos of this Ruby group. Time seems to alter them all similarly; and the author believes that Kinos of all these species, provided the same period has elapsed since exudation, and they have been exposed to similar climatic influences, tend to have precisely the same appearance and composition. He has given a few notes on the appearance of those of different species partly with a view to bring out the relationship between physical appearance and chemical composition, and partly with the view to furnish the fullest particulars in regard to these little-known substances. It must be borne in mind that the dates given are either those of collection or of receipt, and *not* of exudation, so that they do not, in many cases, give a precise idea of their comparative ages. But appearance and composition of the Kinos give, he believes, an infallible clue to their ages. With not much diffidence he hazards the belief that when a series of Kinos just exuded shall have been collected, and thus their ages known at the time of different experiments, it will be found that the percentages of tannic acid, for instance, will be in inverse ratio to their ages.

EUCALYPTUS AMYGDALINA, *Labill.*, B.Fl. iii. 202 (Syn. *E. fissilis*, F.v.M.; *E. radiata*, Sieb.; and other synonyms).

This Eucalypt has more than a score of vernacular names, but in regard to this species, as in others, only those vernacular names have been used which are actually employed to describe the tree in the locality given.

Found in Tasmania, Victoria, N. S. Wales.

1. *E. amygdalina* var. *radiata*. "Ribbon Gum." Nelligen, Clyde River, N.S.W. Collected 21st and 22nd September, 1886. Height, 100-120 ft.; diam., 2 ft. 6 in.

A clear port-wine coloured Kino, which is fairly friable, yielding a sparkling powder. It is not readily obtainable in large pieces. It dissolves readily in cold water, forming a clear, medium ruby liquid, but the residue contains more woody matter than the Bombala sample, and less phlobaphene. Colour of residue Vandyke brown.

(*Note.*—Colours are taken from *damp* residues. The colours of aqueous solutions were taken from ½ gram. of powdered Kino in 100 cc. of water, which stood for three days, and the colour estimated by placing the liquid in a bottle 2 inches in diameter.)

Kino-tannic acid, 62·95 per cent.; insoluble phlobaphenes, 6·46 per cent.; soluble in cold water, 92·54 per cent.*

2. *E. amygdalina*, var. "Peppermint." Bombala, N.S.W. Collected 14th Feb., 1887. Height, 60-80 ft.; diam., 3 ft. Physical description same as No. 1.

In cold water it forms a solution of a pale ruby colour. The insoluble phlobaphene is very dark, almost black. Colour of residue purplish-brown.

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* The remainder of these Kinos consists for the most part of hygroscopic moisture (average 20 per cent.), together with small percentages of sugar, resin, &c. I have made complete analyses of them, but the descriptions of the raw products themselves, and an account of the botanical questions involved in the elucidation of them, can alone properly be brought before this Society.

Kino-tannic acid, 62·58 per cent.; insoluble phlobaphenes, 6·58 per cent.; soluble in cold water, 92·62 per cent.

3. *E. amygdalina*, var. "Peppermint." (This and the preceding tree are very different in appearance.) Little River, near Braidwood, N.S.W. Collected 11th November, 1886. Height, 60-80 ft.; diam., 1-2 ft. Physical description same as "Ribbon Gum."

To cold water it yields a perfectly clear pale ruby solution, with insoluble phlobaphene of the same colour. Residue contains a few particles of ligneous matter. Colour of residue Vandyke brown.

Kino-tannic acid, 62·4 per cent.; insoluble phlobaphenes, 5·5 per cent.; soluble in cold water, 93·4 per cent.

Following is the description of a sample of *E. amygdalina* Kino examined by Dr. Wiesner (Pharm. Journ. [3] ii. 102):—"Easily soluble in water, solution neutral, onion-red, turbid * on cooling. Black particles, and only in very thin fragments zircon-red in transmitted light, fatty lustre, very tough, rich in fibrous bark."

4. This sample had been collected for an indefinite period when received on 29th December, 1887. No particulars are available.

This and the following Kino, received from the Sydney Botanic Gardens, are very similar in outward appearance, and the same description will apply to both. They have obviously been collected for a very considerable period, are bright and black, and look very much like little pieces of jet. Although of a horny nature, it is not very difficult to reduce them to a coarse black sparkling powder, as they are rather brittle, but it is very difficult to rub them down into an impalpable powder, which is dull, and in colour purplish-brown with a predominance of red, and inclining to Venetian red.

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* There is some mistake here; his labels have probably got mixed. I have examined scores of Kinos of this species. The same remarks also apply to *E. pilularis*, *infra*, a common Sydney species.

Cold water acts with extreme slowness upon this Kino, and a dark ruby liquid is the result, with nearly black insoluble phlobaphenes. The soluble phlobaphenes possess very powerful colouring properties.

Kino-tannic acid, 35·78 per cent.; insoluble phlobaphenes, 35·8 per çent.; soluble in cold water, 55·4 per cent.

5. Sample sent as *E. fissilis.* For physical description see previous specimen (No. 4). Cold water yields a dark ruby solution inclining to orange. The Kino dissolves slowly, leaving a residue of phlobaphene almost entirely of a rich red-brown colour, with but a very small proportion of black.

Kino-tannic acid, 30·59 per cent.; insoluble phlobaphenes, 40·9 per cent.; soluble in cold water, 50·1 per cent.

Following is Dr. Wiesner's description of a sample of *E. fissilis* Kino examined by him :—" Reddish solution, neutral, remaining clear on cooling, trace of gum-resin. Tough drops, blackish-red, zircon-red, translucent, fatty lustre on fracture."

6. *E. amygdalina*, var. No local name. Appears to be scarce. Has a bark something like "Mahogany" *(E. robusta).* Cambewarra, N.S.W., 30th May, 1888. Height, 60-80 ft. ; diam., 2-3 ft.

The greater portion of the small sample obtained has evidently remained long on the trees. A few freshly exuded drops are of a clear reddish-brown colour ; the remainder is so opaque that its colour by transmitted light can scarcely be determined, though at the edges of some pieces a reddish-brown colour is observed. The general colour by reflected light is Vandyke brown, and the Kino cuts like horn.

Cold water forms a pale orange-brown solution. It is, however, all but insoluble. Alcohol (B.P. strength of tincture) yields a pale brown liquid, and a granular almost black residue of phlobaphenes.

This sample is chosen as an example of the effect of age on a ruby Kino. The tendency to insolubility has proceeded to an even greater extent in the case of the specimen which follows (No. 7).

Kino-tannic acid, 12·4 per cent.; insoluble phlobaphenes, 60·5 per cent.; soluble in cold water, 24·2 per cent.

7. *E. amygdalina*, var. "Messmate." Nowra, August, 1888. Height, 100-150 ft.; diam., 2-6 ft.

This sample has also been chosen to illustrate the effect of extreme age on a ruby Kino. It has been obtained from the interior of the wood, and incrusts or is attached to the chamois-leather fungus *(Xylostroma giganteum*, Fries). It bears a remarkable resemblance to vulcanite, but it is scarcely of a pure black, being of a uniform Vandyke brown. Its fracture is conchoidal, and of an "egg-shell black." It is about as hard as vulcanite, and its powder (difficult to obtain on account of the toughness of the material) is of a burnt-umber colour. It yields practically nothing to boiling water, alcohol or ether, and consists almost entirely of phlobaphenes.

8. *E. amygdalina*, var. (near *E. regnans*, F.v.M.). "Cut-tail," "Bastard Black-butt." Tingiringi Mountain, Delegate, N.S.W., 2nd March, 1889. Height, 200-300 ft.; diam., 3-6 ft.

A fresh Kino which appears in no way to differ from that of fresh normal *E. amygdalina.*

EUCALYPTUS EUGENIOIDES, *Sieb.* Made a variety of *E. piperita* in B. Fl. iii. 208.

Found in Victoria and N. S. Wales.

9. "Broad-leaved Stringybark." Bangley Creek, Cambewarra, 15th March, 1888. Obtained from various trees from 60-80 ft. high, and 1-2 ft. in diam. Kino very scarce.

This has been quite freshly exuded, and is for the most part of pale ruby colour, although particles of it are of deeper tint. It

is transparent and bright-looking, and easily powdered. Fragments of the very fibrous bark are usually attached to the pieces.

In cold water it forms a clear solution of a pale ruby colour. Residue Vandyke brown.

Kino-tannic acid, 65·48 per cent.; insoluble phlobaphenes, 3·6 per cent.; soluble in cold water, 96·0 per cent.

10. "Broad-leaved Stringybark." Bangley Creek, Cambewarra, 29th March, 1888. Height, 40-60 ft.; diam., 1-2 ft.

This specimen was obtained in the same neighbourhood as the preceding one, but it is by no means so fresh-looking, having obviously remained on the trees for a much longer time.

Cold water yields a medium ruby liquid. Colour of residue Vandyke brown.

Kino-tannic acid, 59·37 per cent.; insoluble phlobaphenes, 7·5 per cent.; soluble in cold water, 91·6 per cent.

11. "Stringybark." Between the Valley and Springwood, Blue Mountains, N.S.W., 3rd April, 1888. Height, 60 ft.; diam., 1 ft.

Kino of this species is difficult to collect, like that of other stringybarks, as it becomes firmly cemented to the fibrous bark. It is something like *E. obliqua* Kino, but perhaps more similar in appearance to that of *E. piperita* from the same locality. It is intermediate in toughness between the two Kinos. Colour of powder purplish-brown.

Cold water forms a medium ruby liquid, inclining to reddish-brown. Residue dark brown.

Kino-tannic acid, 64·26 per cent.; insoluble phlobaphenes, 2·5 per cent.; soluble in cold water, 97·0 per cent.

12. "Stringybark." Barney's Wharf, Shoalhaven, N.S.W., August, 1888. Height, 60-80 ft.; diam., 2-3 ft. Freshly exuded; of a rich ruby colour. Yields a pale ruby liquid to cold water.

Kino-tannic acid, 65·46 per cent.; insoluble phlobaphenes, 2·9 per cent.; soluble in cold water, 96·4 per cent.

EUCALYPTUS HÆMASTOMA, *Smith*, B.Fl. iii. 212.

Found in Tasmania, Victoria, N. S. Wales and Queensland.

The specific gravity of a sample of Queensland Kino from this species is about 1·378, and the percentage of tannin 64·51, according to Mr. Staiger.

13. Rough or Small-leaved "Stringybark." Lyttelton (Colombo), Candelo, N.S.W., 24th December, 1886. Height, 40-60 ft.; diam., 2 ft.

When freshly exuded this Kino is of a clear light ruby colour, becoming more or less opaque and of a Vandyke brown colour, like other ruby Kinos, if it remains sufficiently long on the trees. It is clean to handle, powders fairly readily, forming a light purplish-brown powder. In cold water it forms medium ruby-coloured liquid. Colour of residue Vandyke brown.

Kino-tannic acid, 57·35 per cent.; insoluble phlobaphenes, 11·4 per cent.; soluble in cold water, 88·0 per cent.

14. Received from Mr. F. M. Bailey, Government Botanist of Queensland, 28th February, 1888, but no particulars are available. It is in rather larger and more rounded pieces than the sample from Colombo, and has evidently been collected for a longer period than the former. It is bright-looking, and of such a deep garnet colour as to be almost opaque.

To cold water it yields a solution of a medium ruby colour with a little brown in it. Residue Vandyke brown.

Kino-tannic acid, 59·92 per cent.; insoluble phlobaphenes 11·76 per cent.; soluble in cold water, 87·8 per cent.

EUCALYPTUS MACRORRHYNCHA, *F.v.M.*, B.Fl. iii. 207.

Found in Victoria and N. S. Wales.

15. "Stringybark." Amboyne, Delegate, N.S.W., 25th May, 1887. Height, 80-120 ft.; diam., 2-4 ft.

Of a rich ruby colour. This particular sample is rather friable, and for this reason appears of a dull colour, unless it has been very little handled. It reminds one somewhat of some specimens of seed-lac.

To cold water it yields a medium ruby-coloured solution. The residue contains particles of fibrous bark, together with phlobaphene of a dark ruby colour. Residue Vandyke brown.

Kino-tannic acid, 64·4 per cent.; insoluble phlobaphenes, 5·52 per cent.; soluble in cold water, 93·78 per cent.

EUCALYPTUS OBLIQUA, *L'Hérit.*, B.Fl. iii. 204 (Syn. *E. gigantea*, Hook. f.; and other synonyms.)

Found in South Australia, Victoria, Tasmania, and N. S. Wales.

Following are the results of Dr. Wiesner's examination of two Kinos of this species:—

"*E. gigantea.* Little soluble in water; solution brownish, neutral, no turbidity, rich in gum-resin. Tough, drop-like pieces, of a zircon red.

"*E. obliqua.* Taken as identical with *E. gigantea.* Completely soluble in water, with deep red colour, neutral, no turbidity, free from gum-resin. Looks like Kino. . . .

"*E. gigantea.* Add to solution first HCl and then NH_4 HO, yellowish-red ppt, which on exposure to the air becomes of rusty red.

"*E. obliqua.* Dark violet ppt under the same circumstances."

The first sample was evidently much older than the second.

16. "Stringybark." (Botanic Gardens, Sydney, received 29th December, 1887.)

Another Kino which must have been collected for a very long period. It looks perfectly black by reflected light, and has much the appearance of jet. It is fairly brittle, but rather difficult to reduce to an impalpable powder, which is rich Vandyke brown in colour.

Cold water yields a clear dark reddish-brown solution. The phlobaphene residue is very abundant, and almost a perfect model of the original Kino.

Kino-tannic acid, 21·4 per cent.; insoluble phlobaphenes, 48·52 per cent.; soluble in cold water, 38·9 per cent.

EUCALYPTUS PAUCIFLORA, *Sieb.* (Syn. *E. coriacea*, A. Cunn., the species name in B.Fl. iii. 201, and a more correct one than Sieber's.)

17. "Cabbage Gum." Monga, near Braidwood, 1st and 2nd October, 1886. Height, 60-80 ft.; diam., 1-2 ft. A free yielder of Kino in this district.

This Kino is rather tenacious, adhering to pestle and mortar, and yielding a dull orange-tinted powder. It dissolves readily and almost entirely in cold water, forming a medium ruby liquid, with a garnet residue.

Kino-tannic acid, 55·37 per cent.; insoluble phlobaphenes, 8·6 per cent.; soluble in cold water, 91·8 per cent.

EUCALYPTUS PILULARIS, *Smith*, B.Fl. iii. 208.

Found in Victoria, N. S. Wales, and Queensland.

Following are Dr. Wiesner's remarks on a sample of this Kino :—

"Readily soluble in water, red solution, faintly acid, turbid * on cooling, traces of gum-resin. Pieces opaque, earthy, or with slight fatty lustre, dark reddish-brown."

18. "Blackbutt." Eastwood, near Sydney, 28th April, 1888. Height, 50 ft.; diam., 1 ft.

In outward appearance this Kino so closely resembles the sample *E. piperita* (Valley), as to be scarcely distinguished from it.

Cold water dissolves it readily, forming a quite clear liquid. Like very new Kinos it has a purplish rose tint. Colour of residue Vandyke brown.

Kino-tannic acid, 65.52 per cent.; insoluble phlobaphenes, 2·8 per cent.; soluble in cold water, 96·4 per cent.

* There is some mistake here.

EUCALYPTUS PIPERITA, *Smith*, B.Fl. iii. 207.

Found in Victoria and N. S. Wales.

Dr. Wiesner says of a sample :—

"Easily soluble in water; solution yellowish-red, neutral, free from gum-resin. No turbidity on cooling. Dense pieces of zircon-red, translucent."

19. *E. piperita*, var. "Messmate," or "Narrow or Almond-leaved Stringybark." Brooman, Clyde River, N.S.W., 14th September, 1886. Height, 100-120 ft.; diam., 2-3 ft.

One of the clear ruby or garnet Kinos. Some of it is in rather large pieces, and is rather hard and tough. It has a very bright fracture.

Cold water dissolves it to a medium ruby-coloured liquid, leaving a residue consisting chiefly of phlobaphenes. Colour of residue dark purplish-brown.

Kino-tannic acid, 59·78 per cent.; insoluble phlobaphenes, 8·7 per cent.; soluble in cold water, 90·84 per cent.

20. "Stringybark." The Valley, near Springwood, N.S.W., 4th April, 1888. Height, 80 ft.; diam., 4 ft.

The description given of the Brooman sample (No. 18) applies here exactly. The only perceptible difference is that the specimens from the Valley are a little lighter in colour because fresher. It is very tough to powder, and can be cut in pieces with a knife.

Except that it is rather more easy of solution, to be accounted for by its more recent collection, this sample behaves exactly like the Brooman sample when in cold water. Colour of residue Vandyke brown.

Kino-tannic acid, 62·91 per cent.; insoluble phlobaphenes, 5·1 per cent.; soluble in cold water, 94·1 per cent.

21. "Peppermint," "Messmate." Barney's Wharf, Shoalhaven N.S.W., August, 1888. Height, 60-80 ft.; diam., 2-3 ft.

A rather handsome Kino. Freshly exuded, of a pale ruby colour; a portion of it is in very thin fragments, and shows a colour like orange lac. Much of it has been allowed to flow into a vessel and therefore is nearly pure.

Cold water yields a very pale ruby solution with a tint of rose. Colour of residue brown.

Kino-tannic acid, 67·52 per cent.; insoluble phlobaphenes, 4·0 per cent.; soluble in cold water, 95·4 per cent.

EUCALYPTUS SIEBERIANA, *F.v.M.* (Syn. *E. virgata*, Sieb., the species name in B.Fl. iii. 202).

Found in S. Australia, Tasmania, Victoria, and N. S. Wales.

22. "Mountain Ash." I have obtained a sample of Kino from this species (Mt. Victoria, N.S.W., March, 1889), which is an ordinary ruby Kino, both in appearance and chemical deportment.

23. "Mountain Ash," "Black Ash." A second sample of Kino of this species is from Tantawanglo Mountain, near Candelo, N.S.W., and is from a tree 60-80 ft.; diam., 2-6 ft. It was collected 12th July, 1889. It has exuded for a much longer time than the preceding sample. Neither has been quantitatively analysed.

EUCALYPTUS STELLULATA, *Sieb.*, B.Fl. iii. 200.

Found in Victoria and N. S. Wales.

24. "Sally or Black Gum." Bombala, N.S.W., 17th Feb., 1887. Height, 30-50 ft.; diam., 2 ft.

A ruby Kino similar to most of the others in general appearance.

It yields a medium ruby liquid, with some phlobaphene residue and a few particles of woody matter. Colour of residue purplish brown.

Kino-tannic acid, 61·97 per cent.; insoluble phlobaphenes, 7.2 per cent.; soluble in cold water, 92·42 per cent.

ON RHOPALOCERA FROM MT. KOSCIUSKO, NEW SOUTH WALES.

By A. Sidney Olliff, F.E.S.
Assistant Zoologist, Australian Museum.

Our knowledge of the Rhopalocera of Mt. Kosciusko, the highest point of Australia, has hitherto been confined to the four species obtained by Mr. E. Meyrick in January, 1885, and recorded by him in September of the same year in an account of his journey, which, he tells us, was chiefly made in the interests of Entomology, and more especially in search of micro-lepidoptera.* Of the four species obtained by Mr. Meyrick two proved to be undescribed; the others were widely-distributed and abundant species.

To this meagre list I am now able to add fifteen species, three of which are new, from material collected by Mr. R. Helms during an excursion which he made on behalf of the Australian Museum in March and April of the present year. As far as Entomology is concerned this expedition was most successful, in spite of the fact that the collecting season was almost over, and Mr. Helms is to be congratulated upon the results of his undertaking. Like Mr. Meyrick, I was in hopes that some form of Satyridæ allied to *Erebia* would be found on Mt. Kosciusko, and I asked Mr. Helms, who is familiar with those found in the mountains of New Zealand, to do his utmost to ascertain if such a form exists, but his efforts met with no success.

1. Pyrameis cardui, Linn., var. Kershawi, McCoy.

Moonbar (3-3,500 feet), Mt. Kosciusko (5,000 feet); several very darkly coloured specimens.

2. Pyrameis itea, Fabr.

Moonbar (3-3,500 feet), Mt. Kosciusko (4,000 feet).

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* An Ascent of Mount Kosciusko. Ent. Mo. Mag. xxii. pp. 78-82 (1885).

3. JUNONIA VELLIDA, Fabr.

Moonbar (3-3,500 feet), Mt. Kosciusko (5-6,000 feet).

4. XENICA ACHANTA, Don.

Moonbar (3-3,500 feet).

5. XENICA KLUGII, Guér.

Moonbar (3-3,500 feet), Mt. Kosciusko (5,000 feet).

6. XENICA LATHONIELLA, Westw.

Moonbar (3-3,500 feet), Jindabyne (3,000 feet), near Mt. Kosciusko, in March; common.

Perhaps a trifle darker than the typical form, but scarcely distinguishable from specimens obtained at Warra, on the Liverpool Plains.

7. XENICA ORICHORA, Meyr.

Mt. Kosciusko (5-6,000 feet), in March; abundant. Expanse, ♂ 32-35 mm.; ♀ 34-39 mm.

It is a singular fact that amongst some 150 or 160 specimens of the form which I conclude is the *X. orichora* only two individuals—a male and a female—are to be found which agree satisfactorily with Mr. Meyrick's description (Ent. Mo. Mag. 1885, p. 82), inasmuch as the hindwing is provided with an incurved ochreous-whitish marking extending from vein six along the inner margin of the ocellus to above the anal angle. In the two exceptions alluded to this marking is split up into five spots, thus answering to the "inwards-curved row of five ochreous-whitish silvery-tinged indistinct pale ochreous spots in a curved row between ocelli," whose presence is alluded to by Meyrick. In all other respects the fine series before me answers to the description of *X. orichora*. I am inclined to think from the fact that this form, and this form only, is abundant on the higher slopes of Mt. Kosciusko, that it is only a mountain race of *X. lathoniella*; but as the points in which it differs from the typical form (chiefly its darker colouring and its greater profusion of markings) appear to be constant, I think it may be

allowed the distinction of a name. In one or two specimens I have examined the ocellus of the forewing is duplicated.

8. XENICA CORREÆ, sp.n.

Wings above fuscous, with orange-fulvous markings, somewhat like those of *X. lathoniella*, but smaller and more irregular, and with similarly placed ocelli. Forewing with two large slightly oblique transverse spots within the cell, one about the middle, the other before the extremity, a similar and larger spot below the cell in the middle, a series of irregular spots (usually four) beyond cell, at $\frac{2}{3}$ from base, extending from costa to inner margin, of which the first is longitudinal, and the third broadly transverse; a conspicuous white-centred apical ocellus and a minute supplementary ocellus situated within an elongate marking, behind which is a small spot; a hind-marginal series of small spots. Hindwing with three small spots near base, an irregular series of spots extending from beyond costa to above anal angle, three spots extending upwards from anal ocellus, and a distinct hind-marginal series. Forewing beneath dull orange-fulvous, the fuscous markings almost obsolete, except near the costa; a series of whitish hind-marginal spots. Hindwing fuscous, with a black white-centred ocellus, surrounded by an ochreous ring near costa beyond middle, and a similar one above anal angle; four ochreous spots near base, first just beneath costa near base, second beneath first, third beyond second towards extremity of cell, fourth below second; an outwardly curved silvery band from middle of costa to above anal angle, interrupted at vein 5 and sometimes at vein 6; three rather large indistinct ochreous spots between ocelli; a hind-marginal series of elongate silvery spots, from which the dark hind-margin is divided first by a fuscous and then by an ochreous line. Expanse, ♂ 33-37 mm; ♀ 36-40 mm.

X. FULVA, var.nov. Underside dull orange-fulvous, marked with fuscous, the white and silvery markings of the typical form entirely absent, their size and position being indicated by indistinct fulvous markings; ocelli smaller and less conspicuous.

Mt. Kosciusko (5-6,000 feet) in March; a considerable number were taken flying over a low-growing shrub, *Correa lawrenciana*, Hk., upon which Mr. Helms is convinced, and I think with reason, the larva of the butterfly will be found to feed.

This somewhat variable species is often without the minute extra white-centred ocellus in front of the ordinary ocellus of the forewing, and occasionally the band on the underside of the hindwing, which usually extends continuously from the costa to above the anal angle, is broken and slightly separated at vein five. It is evident that it is allied to *X. orichora;* but the veins at the base of the hindwings are not marked with ochreous-whitish streaks as they are said to be in that species, nor is the inner margin ochreous-whitish. In these two points it also differs from *X. lathoniella*, and what is more it does not agree with either in having the spots at the base of the hindwings fulvous, or in the general disposition of the markings, particularly of those on the upperside of the forewings.

9. Heteronympha philerope, Boisd.

Moonbar (3-3,500 feet), Mt. Kosciusko (5,000 feet).

Apparently this species has a wide range; it is found in North-West Australia, and throughout the Southern colonies, and recently I have seen specimens from Lord Howe Island.

10. Heteronympha merope, Fabr.

Jindabyne (3,000 feet).

11. Heteronympha cordace, Hübn.

Moonbar (3-3,500 feet).

12. Zeritis discifera, Herr.-Sch.

Moonbar (3-3,500 feet).

13. Lampides alsulus, Herr.-Sch.

Jindabyne (3,000 feet), Moonbar (3-3,500 feet), Mt. Kosciusko (5,000 feet).

The specimens from the higher elevations are exceedingly small.

14. LAMPIDES AGRICOLA, Westw.

Mt. Kosciusko (5,500 feet).

15. IALMENUS EVAGORAS, Don.

Jindabyne (3,000 feet).

16. BELENOIS TEUTONIA, Fabr.

Mt. Kosciusko (5,500 feet).

17. TELESTO DRACHMOPHORA, Meyr.

Moonbar (3-3,500 feet); abundant.

A fine series of this species, which also occurs in Tasmania where it was captured both by Mr. G. Barnard and myself, was obtained by Mr. Helms. The silvery-white spots composing the discal band on the hindwings vary in size to a slight extent, but otherwise their peculiar markings appear to be fairly constant.

18. HESPERILLA MUNIONGA, sp.n.*

Thorax and abdomen dark fuscous brown, segmental margins of the latter whitish-ochreous. Head dark brown, spotted with ochreous; beneath whitish; palpi black, whitish beneath, except at the tips; antennæ black, spotted with yellow beneath. Forewing dark fuscous, some fulvous hairs near base, a whitish-ochreous oblique spot at end of cell, and three similar but smaller spots beyond middle, the first near costa at $\frac{3}{5}$ from base, divided into three parts by fuscous veins, the second behind first on disc, the third small, behind second, near inner margin $\frac{2}{3}$ from base, the three together forming an oblique series nearly parallel to the hind-margin. Hindwing dark fuscous, with an oblique transverse orange coloured band. Cilia of both wings whitish-ochreous, barred with fuscous. Forewing beneath fuscous, marked as above, except that the spot near costa is absorbed in a large ochreous apical marking which extends from costa at $\frac{3}{5}$ from base to just before middle of hind-margin; within this marking are three sub-apical, and a hind-marginal series of four small fuscous spots. Hindwing beneath ochreous, sometimes orange yellow, a dark fuscous spot at base, and three transverse series of elongate fuscous spots, the first before the middle, the second just behind

* Munyong is the native name of Mt. Kosciusko

the middle, the other hind-marginal. Expanse, ♂ 29-30 mm ; ♀ 33-35 mm.

Moonbar (3-3,500 feet), Mt. Kosciusko (5,000 feet); taken sparingly in March.

Allied to *Hesperilla ornata*, Leach, but the underside of the hindwings is very different, being more profusely marked with fuscous spots and quite differently coloured.

19. Hesperilla monticolæ, sp.n.

♂. Head, thorax, and abdomen dark fuscous; palpi whitish, tipped with fuscous; antennæ black, annulated with whitish, beneath ochreous. Forewing dark fuscous, with three white spots, the first near costa at about $\frac{3}{4}$ from the base, divided into three parts by fuscous veins, the second just beyond middle at end of cell, the third at lower angle of cell, divided into two parts by fuscous vein. Hindwing with white spot on disc near middle, divided by fuscous vein. Cilia of both wings ochreous-white, barred with fuscous. Beneath both wings greyish fuscous, inclining to ochreous. Forewing with ochreous hairs near base, marked as above, whitish from apical angle to middle of hind-margin. Hindwing with broad longitudinal bars of whitish; one in the middle extending from base to hind-margin conspicuous, interrupted before extremity of cell where there is a fuscous spot, and again about midway between cell and hind-margin; an indistinct white bar near costa; a third near inner margin; both interrupted by an indistinct fuscous spot at about $\frac{2}{3}$ from base. Expanse 24-25 mm.

Moonbar (3-3,500 feet), in March; rare.

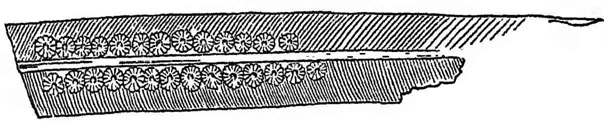
In the male, which is the only sex known to me, there is a conspicuous black sexual bar. The species is somewhat like *Hesperilla (Cyclopides) cynone*, Hew.,* in the disposition of its markings, but it is abundantly distinct, and as it does not appear to agree with any of the species described by Plötz, Mabille, and other writers who have recently turned their attention to the Hesperiidæ, I conclude it has not hitherto been characterised.

* Exot. Butt. V. p. 115, pl. 60, fig. 17 (1876).

NOTE ON THE FRUCTIFICATION OF *PHLEBOPTERIS ALETHOPTEROIDES*, ETHERIDGE, FIL., FROM THE LOWER MESOZOIC BEDS OF QUEENSLAND.

By R. Etheridge, Junr., &c.

In the "Proceedings" of this Society for last year * I gave a description of a fern from the Lower Mesozoic beds of the Darling Downs, to which the above name was given, but up to that time no trace of the fructification had been observed. On looking over some miscellaneous fossils in the collection of the Mining and Geological Museum, Department of Mines, I found a few additional examples of this species, one of which shows the fructification distinctly.



×2.

In the genus *Phlebopteris* the sori are borne at the ends of certain of the nervules, which do not reach the margin of the pinnules, but are arrested half-way.† This is exceedingly well shown in Brongniart's figure of *P. polypodioides*;‡ and although these smaller nervules cannot be distinguished in the present specimen, from its condition of preservation, the position of the sori is similar to that given in the figure quoted.

* Proc. Linn. Soc. N. S. Wales, 1888, iii. (2), p. 1306, t. 38, f. 1 and 2.

† Schimper, Traité Pal. Vég. I. p. 624.

‡ Hist. Vég. Foss. t. 83, f. 1 and 1a.

In general appearance the fructification of our fossil greatly resembles that of *P. crenifolia*, Phillips,* but in its minute structure is much like that of *P. Schouvii*, Brong.† In its present state it possesses a stellate appearance, and occupies a very considerable portion of the surface of the pinnule. It would seem that the indusium had in each case burst, leaving the interiors of the sori exposed, in which case the sporangia are represented by the small radiating sub-divisions.

The fossil is from the same locality as former specimens, viz., Darling Downs, near Toowoomba.

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* Geol. Yorkshire, 2nd Edit. t. 8, f. 11.

† Brongniart, *loc. cit.* t. 132, f. 4a.

NOTE ON THE BIBLIOGRAPHY OF LORD HOWE ISLAND.

By R. Etheridge, Junr., &c.
Palæontologist to the Australian Museum, and Geological Survey of N. S. Wales.

In a work on Lord Howe Island,* recently published by the Trustees of the Australian Museum, I called attention to the general Bibliography of the island, and regretted my inability to refer to a report by a Dr. Foulis, who was said to have passed three years there as a resident. I further stated that Mr. Surveyor H. F. White's report, who surveyed Lord Howe Island in 1835, "did not seem to have been published." I am now indebted to the kindness of Prof. W. J. Stephens, M.A., in calling my attention to the "Votes and Proceedings of the Legislative Council of New South Wales"† for 1853, in which Dr. Foulis's account appears, and also a short one by Mr. White. They form a part of the papers relating to a "Proposed New Penal Settlement," the formation of which was contemplated by the authorities at that time. These old papers, however, reveal much more than the above even, for accompanying them are reports by Captain H. M. Denham, R.N., of H.M.S. "Herald," and that accomplished naturalist, Dr. J. Denis Macdonald, who acted as surgeon to Captain Denham's South Pacific Exploring Expedition. It may not be without interest to briefly recapitulate some of the more important facts detailed by these observers.

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* Lord Howe Island: its Zoology, Geology, and Physical Characters. *Mem. Australian Mus.*, 1889, No. 2. (8vo. Sydney, 1889.)

† Votes and Proceedings of the Legislative Council, 1853, 268, A. (2 vols. fcap. Sydney, 1853.)

The report of Mr. Surveyor H. J. White,* entitled "Report on Lord Howe Island," is dated 1835, and is a very brief one. It gives the area of the island at 3,230 acres, of which 1,000 are "sufficiently level, although too sandy for cultivation," as against 3,220 acres and 2,000 acres, respectively, given by the Government Botanist, Mr. Charles Moore.† He further mentions the small lagoon in the centre of the island shown on his chart, but of which we could find no trace during our visit. The population at the time of Mr. White's survey consisted of four men, three New Zealand women, and two children.

The report of Dr. John Foulis, dated September 1st, 1851, and sixteen years after White's, is a "Statement of Circumstances in reference to Lord Howe's Island, situated off the coast of New South Wales, between the Heads of Port Jackson and Norfolk Island." Dr. Foulis's residence extended to three years. He describes the island as thirty-five miles in circumference, the coral reef two miles from the shore and ten miles in length! As a matter of fact, the reef is but one mile from the western coast, and is between three and four miles long, extending across the bay formed between Phillip Point and the western foot of Mount Ledgebird. Amongst other zoological notes five kinds of fish are recorded, and it is stated that whales are "in the habit of breeding near the reef at certain seasons;" a large blue pigeon and parrots are also mentioned, thus supporting the statement of the late Mr. E. S. Hill as to the presence of these birds on Lord Howe Island, and confirmed by the evidence our party gathered on the same subject. In connection with the geology, Dr. Foulis mentions one or two interesting facts, such as the "bones of turtle and sea shells" occurring in the "soft sandstone hills and cliffs" forming the lower ground. He also noticed extensive and deep beds of clay scattered over the island, one of those, in a well-sinking, being as much as fourteen feet thick. The turtle

* Not H. F. White, as generally stated.

† Lord Howe Island, &c. By Edward S. Hill, 1870 (8vo. Sydney, 1870) p. 14.

bones are evidently those of the extinct genus *Meiolania*, and the extent of the clay beds is quite borne out by the investigations made by the writer on the spot.* On the chart accompanying this report Mutton-bird Island is called Inaccessible Island, a very appropriate name, and which, as a matter of precedence, would appear to be its proper designation. Sixteen people were resident on Lord Howe Island at this time.

Dr. Foulis's report is followed by a brief one by Captain H. M. Denham, dated 1853—"Remarks on Lord Howe Island." He places the "Madeira of the Pacific" in 31° 31′ S. Lat., and 159° 5″ E. Long., which only differs from the careful observations of Mr. W. J. Conder, the Superintendent of the Trigonometrical Survey in 1882, by 2′ S. Lat., the latter observer giving its position as 31° 33′ S. Lat. The sixteen inhabitants mentioned by Dr. Foulis formed the families of Andrews, Mosely, and Wright, "who dropped into sole occupancy in 1843, from having been in the service of a 'Captain Poole.'"

We now come to the interesting paper by Dr. Macdonald—"Remarks on the Natural History and Capabilities of Lord Howe Island."

I much regret that this did not come under my observation at the time I wrote the account of our operations at the island, as it would have given me great pleasure to have made copious extracts from it. Dr. Macdonald describes the geology somewhat fully, and his observations are, I am glad to say, quite in keeping with those made by myself. He noticed the two chief rock masses of the island, the volcanic series in horizontal layers, intersected by dykes; and the coarse later sandstone. These he traced out with commendable accuracy, noticed the occurrence of grey pummice on all low lands, and also the unconformity existing between the two divisions of the Coral sand-rock, described by myself.† In mentioning the lagoon within the coral-reef, Dr. Macdonald states that in September during low tides it became dry, and that it was

* Mem. Australian Mus. 1889, No. 2, pp, 114 and 120.

† Mem. Australian Mus., 1889, No. 2, p. 118.

possible to walk across to Rabbit Island. He also refers to the fact that the inland or fresh-water lagoon had disappeared, a fact also in accord with our observations. In his ornithological notes he speaks of two kinds of Mutton Bird, one brown or black, the other white and a winter visitant. The former would be either *Puffinus brevicaudus*, Brandt, or *P. sphenurus*, Gould, but the identity of the latter is puzzling. The writer also records a visit of swallows, and a flight of wild duck during his visit to Lord Howe Island. One very interesting fact recorded by Dr. Macdonald is the occurrence of the Cape Pigeon, *Daption capensis*,* around Ball's Pyramid, because we observed this species about Lat. 32° S., when proceeding to the island in the s.s. "Taupo."

Under the head of reptiles, Dr. Macdonald recorded two lizards, and a "small dark coloured land snake," but non-venomous. Now, if there is no mistake here, this statement is of importance, because from all accounts, Ophidians are supposed to be non-existent there, and our researches certainly did not reveal any trace of this order.

The remaining classes of the animal kingdom are touched upon by the author, who mentions the occurrence of the Pearly Nautilus (*Nautilus pompilius*, Linn.), and a small *Pentacrinus*, neither of which came under our observation. This very interesting report concludes with a short account of the botany and general capabilities of Lord Howe Island.

If I am not very much mistaken, a French translation of the foregoing has appeared, for my colleague, Mr. Whitelegge, on looking up other matters in the Royal Society's Catalogue of Scientific Papers, found under Dr. Macdonald's name the following title: "Note sur la Topographie et l'Histoire naturelle de l'île de Lord Howe," published in a French naval medical journal,† which, I regret to say, is not procurable here. Notwithstanding the discrepancy in the date, this and the official report are probably one and the same.

* Termed *Procellaria capensis*, by Macdonald.

† Archives de Méd. Navale, 1872, xvii. p. 241.

When speculating on the geological history of Lord Howe Island,* I referred to the 1000 feet submerged bank which extends north-westerly from New Zealand to Lord Howe, and quoted Mr. A. R. Wallace's view on the subject. I should also have added that those interested in the possible oscillations of old land surfaces in the South Pacific from Australia eastward, and since Jurassic times, cannot do better than consult the highly interesting and instructive addresses of Prof. F. W. Hutton "On the Origin of the Fauna and Flora of New Zealand."† In these papers a very exhaustive account is given of the possible extension of land around New Zealand in former times towards New Guinea by New Caledonia and Fiji, reaching even to South America; besides a lucid exposition on the origin of the present fauna and flora of New Zealand.

In conclusion, I may remark that the deposit at Lord Howe Island I have called the "Coral sand-rock,"‡ appears to be very much akin to the "beach sand-rock" described by Dr. H. B. Guppy,§ as found at the margins of coral islets around the Solomon Group, and its formation seems to have given rise to much speculation in his mind, as it did in mine, when at Lord Howe Island.

Addendum, 20th August, 1889.

The original chart of Lord Howe Island, believed by us to be unpublished, and of which we were supplied with a tracing by the Deputy Surveyor-General, I find was published in Governor Phillip's "Voyage to Botany Bay" (4to, London, 1790, p. 183).

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* *Loc. cit.* p. 122.

† No. I. Presidential Address to the Philosophical Institute of Canterbury, 1st November, 1883; No. II. Annual Address to the same, 6th November, 1884. (See *N. Z. Journ. Science*, ii. p. 1).

‡ Loc. cit. p. 115.

§ The Solomon Islands: Their Geology, &c., 1887, p. 84.

NOTES AND EXHIBITS.

Dr. Ramsay sent for exhibition (1) numerous specimens of *Peripatus* collected by Mr. Helms, on behalf of the Australian Museum, at high altitudes on Mount Kosciusko, N.S.W.: (2) three species of the smaller white Cockatoos, *Cacatua sanguinea*, Gould, *C. gymnopis*, Sclater, and *C.* n.sp., the latter being about the size of *C. sanguinea*, but with no rose or yellowish tints on the crest which is altogether white, the lores with a small spot rose-salmon, and the bare space round the eye comparatively as large as that in *C. gymnopis*, the bare space above the eye narrower; *Hab.*, Lower Darling River: and (3) the skin of a small species of Phalanger (*Pseudochirus*) of a jet black colour, the belly and tip of the tail white; this new species belongs to the same section as *P. cookii* and *P. lanuginosa* (vel *P. peregrinus*); *Hab.*, Bellenden Ker, Queensland, collected by Messrs. Cairn and Grant for the Australian Museum.

Mr. Ogilby exhibited a livihg specimen of a lizard belonging to the curious genus *Phrynosoma*, the "Horned Toads" of the Western United States and Mexico. The present exhibit was obtained in a mine at Denver, Col., by Mr. Sydney Cohen, and by him presented to the Museum. He also exhibited a lizard of the genus *Calotes*, which he believes to be *C. cristatellus*, and which came from N. W. New Guinea, where it was collected by Capt. Strachan, who presented it to the Museum, through the medium of the Nat. Hist. Association; he remarked that so far as he can ascertain this is the first record of the occurrence of the genus in New Guinea. Mr. Ogilby also exhibited the jaws of a species of *Myliobatis* which he is unable to determine, the large central teeth in the lower jaw being sub-arcuate instead of rectilineal as in the other known species; the jaws were sent to the Museum for identification from the Bermagui River by Mr. George Emmanuel.

Mr. William Neill, of the City Bank, sent for exhibition 85 small fishes (*Galaxias* sp.) forwarded to him from London. They were a sample of a quantity weighing 224 lbs taken out of 25 bales of wool shorn on the late Hon. E. Flood's "Midgeon" Station, N.S.W., and subsequently sent to England. The fishes were pumped up from Lake Midgeon in the water used for wool-washing, and became entangled in the wool.

Mr. Whitelegge exhibited the following species of Hydroid Zoophytes from Maroubra Bay obtained among and attached to seaweed washed ashore during the gale last May:—*Sertularia bidens*, Bale, *Diphasia subcarinata*, Busk, *Thuiaria sinuosa*, Bale, *T. subarticulata*, Coughtrey, *Aglaophenia sinuosa*, Bale, and *Halicornaria furcata*, Bale, all additions to the fauna of N. S. Wales. He also exhibited five species of Polyzoa, two of which have not hitherto been recorded from this part of our coasts, viz., *Ascopodaria fruticosa*, Hincks, *Cryptozoon Wilsoni*, Dendy, *Amathia bicornis*, Tenison-Woods, *A. Wilsoni*, Kirkpatrick, and *A. convoluta*, Lamx. A very beautiful specimen of the genus *Isis* was also shown from the same locality.

Mr. Maiden exhibited some enormous leaves (laminæ up to nearly 17 inches) of a Southern Eucalypt, obtained from Bombala, locally known as white gum and giant gum, and doubtfully referred to as *E. goniocalyx*. It is interesting to mention that the trunk of one of these trees was measured by the tape, 3 feet above the ground, and found to be 50 feet in circumference.

Dr. Cox exhibited a fine specimen of a sea snake *(Pelamis bicolor)*, from Botany Bay; a living specimen of a river-limpet *(Ancylus)*, obtained on *Vallisneria*, at Port Hacking, which he proposed to call *A. Smithi;* and drawings of a new variety of *Cypræa*, from Western Australia.

Mr. Thomas offered some remarks on the supposed origin of kerosene-shale from sporangia.

The Rev. J. Milne Curran, of Bathurst, sent for exhibition specimens of a fossil fern (*Tæniopteris*) associated with fossil fishes on the same slab of shale, from the Ballimore Coal Series, 30 miles N.E. of Dubbo; and read the following "Note on some Fossil Fish associated with *Tæniopteris* from the Ballimore Series:—In March, 1884, I contributed a paper to the Society 'On some Fossil Plants from Dubbo,' in which, after enumerating the fossil plants then known, I remarked that 'there are some forms which we should expect which are not as yet recorded from Dubbo, notably *Tæniopteris*' (P.L.S.N.S.W., 1884, p. 254). I have now the pleasure of submitting a specimen of *Tæniopteris*, with the added interest of its being associated with fossil fish. In order to understand the import of the discovery of *Tæniopteris*, I may state that, as pointed out in my paper on the Geology of Dubbo, there are two very distinct formations at Dubbo, namely, the Dubbo Sandstones (Hawkesbury) and the Ballimore Coal Basin (l.c., 1885, p. 175). The Ballimore Series is newer than the Newcastle, and older than the Clarence River beds. The specimen exhibited comes from the Ballimore beds, and is remarkable as the first specimen of *Tæniopteris* found there, and the first fish-remains discovered. *Tæniopteris*, as is well known, is never found at Newcastle or associated with palæozoic plants. As to the fossil fish, I am not competent to say more than that they seem clearly homocercal, and appear to belong to the *Leptolepidæ*."

Mr. Etheridge remarked that a quantity of similar material had been obtained by the Mines Department.

WEDNESDAY, 28TH AUGUST, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

Mr. Hyam was elected a Member of the Society.

The President announced that the next Excursion had been arranged for September 28th, to leave Circular Quay by the 10.30 a.m. steamer for Manly.

DONATIONS.

"Entomologisk Tidskrift." Vols. I.-III., VI., X. (Häft 1) (1880-89). *From the Entomological Society of Stockholm.*

"Royal Society of Queensland.—Report of Annual Meeting held 12th July, 1889." *From the Society.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CVIII., Nos. 19-24 (1889). *From the Academy.*

"Abhandlungen herausgegeben vom naturwissenschaftlichen Vereine zu Bremen." X. Bd., 3 Heft (1889). *From the Society.*

"Catalogue of Books added to the Radcliffe Library, Oxford University Museum, during the year 1888;" "List of Donations during 1888." *From the Library.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 310 and 311 (1889). *From the Editor.*

"Annali del Museo Civico di Storia Naturale di Genova." Serie 2ª., Vols. III.-VI. (1886-88). *From the Museum.*

"Abstracts of Proceedings of the Royal Society of Tasmania." April 16th, May 14th, June 11th, July 9th, 1889. *From the Society.*

"Department of Mines, Sydney.—Records of the Geological Survey of New South Wales." Vol. I., Part 2 (1889). *From the Minister for Mines.*

"Feuille des Jeunes Naturalistes." No. 225 (July, 1889). *From the Editor.*

"The Transactions of the Entomological Society of London for the year 1889." Part II. *From the Society.*

"Report on the Taranganba Gold Mine, Queensland," and "On some Salient Points in the Geology of Queensland." By Robert L. Jack, Government Geologist. *From the Author.*

"South Australia.—Report on the Progress and Condition of the Botanic Garden during the year 1888." By R. Schomburgk, Ph.D., Director. *From the Director.*

"Bulletin de la Société Royale de Géographie d'Anvers." T. VIII. (Fascs. 3 and 4); IX. (Fasc. 3); X. (Fascs. 1, 2 and 6); XI. (Fascs. 1-3); XIII. (Fasc. 2) (1884-88); "Mémoires." Tome II. (1883). *From the Society.*

"Annalen des k.k. Naturhistorischen Hofmuseums, Wien." Band III., No. 2 (1888). *From the Museum.*

"Nova Acta der Ksl. Leop.-Carol. Deutschen Akademie der Naturforscher." Band LII., No. 5; LIII. (Nos. 1-3), (1888-89); "Leopoldina." Heft xxiv. (1888). *From the Academy.*

"Prodromus of the Zoology of Victoria." Decade XVIII. By F. McCoy, C.M.G., F.R.S. *From the Premier of Victoria through the Librarian, Public Library, Melbourne.*

"Bulletin de la Société Zoologique de France pour l'Année 1889." Tome XIV., No. 5 (May). *From the Society.*

"The Victorian Naturalist." Vol. VI., No. 4 (August, 1889). *From the Field Naturalists' Club of Victoria.*

"Bulletin de la Société Impériale des Naturalistes de Moscou." Année 1889, No. 1. *From the Society.*

"Proceedings of the Zoological Society of London, 1889, Part i.;" "Abstract of Proceedings 18th June, 1889." *From the Society.*

"Bulletin of the American Geographical Society." Vol. XXI., No. 2 (1889). *From the Society.*

"The Journal of the Bombay Natural History Society." Vol. IV., No. 1 (1889). *From the Society.*

"Proceedings of the Royal Physical Society, Edinburgh." Vol. IX., Part 3 (1887-88.) *From the Society.*

"Proceedings of the United States National Museum." Vol. XI. (1888), Sheets 20-27, plates 33-40. *From the Museum.*

"Bulletin of the American Museum of Natural History." Vol. II., No. 3 (two Sheets). *From the Museum.*

"The American Naturalist." Vol. XXIII., No. 267 (March, 1889). *From the Editors.*

"The Journal of Comparative Medicine and Surgery." Vol. X., No. 3 (1889). *From the Editor.*

"Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A." Vol. XVI., No. 5 (1889). *From the Curator.*

"The Journal of the College of Science, Imperial University, Japan." Vol. III., Parts 1 and 2 (1889). *From the President of the University.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 44 (August, 1889). *From the Editor.*

"Second, Third and Fourth Annual Reports of the Bureau of Ethnology, Washington, (1880-83)." By J. W. Powell, Director. *From the Director.*

"United States Geological Survey.—Bulletin." Nos. 40-47 (1887-88); "Mineral Resources of the United States, 1887." *From the Director.*

"The Journal of the Cincinnati Society of Natural History." Vols. IV., V. (No. 1), VIII. (No. 3), XI. (No. 4) (1881-89). *From the Society.*

"Proceedings of the Academy of Natural Sciences of Philadelphia, 1888." Parts 2 and 3. *From the Academy.*

"Proceedings of the American Philosophical Society." Vol. XXV., No. 128 (1888). *From the Society.*

"Johns Hopkins University, Baltimore.—Studies from the Biological Laboratory." Vol. IV., Nos. 3 and 4 (1888); "University Circulars." Vols. VII., Nos. 65-67; VIII., No. 68 (1888). *From the University.*

"The Bulletin of Denison University." Vol. IV. (1888). *From the University.*

"Proceedings of the Boston Society of Natural History." Vol. XXIII., Parts 3 and 4 (1886-88). *From the Society.*

"Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg." vii^e. Série. Tome XXXVI., Nos. 3-11 (1888); "Bulletin." Tome XXXII., Nos. 3 and 4 (1888). *From the Academy.*

"Verhandlungen der k.k. Zoologisch-botanischen Gesellschaft in Wien." XXXVIII. Band, 3 & 4 Heft (1888). *From the Society.*

"Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg." Jahrg. XLV. (1889). *From the Society.*

"The Chemist and Druggist." Vol. XXXIV., Nos. 464 and 470 (1889). *From the Editor.*

SPINIFEX RESIN.

By J. H. Maiden, F.L.S., F.C.S.

Last year Sir William Macleay was kind enough to give me "a sample of gum used by the blacks for cementing the heads of spears,* and prepared from Spinifex roots," which had been collected by Mr. Walter Froggatt in the Napier Range (locally called Barrier Range), 100 miles inland from Derby, North-west Australia.

I was dubious as to it being the product of a "Spinifex," never having heard of a grass yielding a resin, but Mr. Froggatt is emphatic that he is not mistaken, nor is so experienced a collector likely to be. The Spinifex is probably *Triodia irritans*, R.Br., but further information on the subject, giving the mode of preparation of the resin would be very acceptable. Mr. Froggatt states that it is obtained from the roots, and local Europeans and aboriginals all make similar statements as to its origin.

It is in a cake about 4 inches in diameter, and 1¼ inch in thickness. The smell is something like beeswax, but at the same time it has an exceedingly disagreeable and persistent odour which is not easily described. It reminds one of the smell of the fabric known as corduroy. It is of especial interest because it is of aboriginal preparation. Its colour is that of a dirty dark bronze-green, or almost of a slaty colour with a little green in it. To the naked eye it looks very like finely chopped hay or grass-seed cemented into a compact mass. It is exceedingly tough, a sharp blow with a hammer on a cold chisel being necessary to fracture it.

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*"The heads of spears from Western Australia in my collection are coated with a hard gum, forming a ridge on one side, in which pieces of glass are impacted." Brough Smyth's *Aborigines of Victoria, &c.*, i., 336. Mr. Froggatt informs me that Spinifex resin is put to such a purpose in the locality from which he obtained it.

Petroleum spirit extracts 3·2 per cent. of a transparent, colourless fixed oil or fat, which possesses a little of the disagreeable odour of the original substance. The solvent extracts no resin. As the substance has been made up into cakes by the blacks, and is to that extent not an absolutely natural product, it may be that the fat, or a portion of it, has been introduced.

The substance was then digested in alcohol, which extracts a transparent, hard, golden-yellow resin possessing some odour, and which appears to be an interesting substance. The amount of this resin is 67·3 per cent., and it darkens on keeping.

Water digested on the residue dissolves out 6·9 per cent. of colouring matter and salts. It contains no arabin. The remainder, 23·1 per cent., consists of dirt and particles of chopped grass. This also is quite free from gummy matter.

Summary :—

Fat, soluble in petroleum spirit............	3·1
Resin, soluble in alcohol....................	67·3
Extractive and salts, soluble in water.....	6·9
Accidental impurity	23·1
	100·4

A second sample, treated with alcohol direct, yielded 70·8 per cent. to that solvent.

PIELUS HYALINATUS AND *P. IMPERIALIS.*

By A. Sidney Olliff, F.E.S.

At the last meeting of this Society (*vide* p. 604) Mr. T. P. Lucas stated that the Hepialid described and figured by Mr. Prince and myself in these Proceedings* under the name *Pielus imperialis* is identical with the *Pielus hyalinatus*, a species which was figured by Herrich-Schäffer in 1853, but not described until 1855 when Walker included a diagnosis of it in the British Museum Catalogue.† Apparently this opinion is based on a comparison of a specimen from Gippsland, identified for Mr. Lucas as *P. hyalinatus* by my friend Mr. Meyrick, and the plates mentioned above. When Mr. Prince and I drew up the description of *P. imperialis* we referred to Walker's description, and with that description our moth does not agree, but we had no opportunity of consulting the figure of Herrich-Schäffer as the book in which it was published is not at present contained in any Sydney library. Recently, however, I have seen a tracing of this figure and I find that it certainly is not identical with that published in our Proceedings. In the first place it appears from the tracing that Herrich-Schäffer's figure represents a moth only about two-thirds of the size of the one figured by us, and that the silver markings on the forewings differ from those of *P. imperialis* both in size, number, and position; moreover, the labyrinthic markings on the forewings are not indicated, and the bright red margin beyond the purple base of the hindwings is much more clearly defined. I think, therefore, that the form *P. imperialis* may be regarded as specifically distinct from, although closely allied to, *P. hyalinatus;* but it is only right to add that this is not the opinion of Mr. Meyrick.

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* Proc. Linn. Soc. N.S.W. (2), II., p. 1015, pl. 39 (1887).

† Cat. Lep. Het. B.M., p. 1576.

That energetic worker at our lepidoptera informs me by letter that he considers *P. imperialis* to be a variety of *P. hyalinatus*, brighter and more finely coloured, and adds that the variation in the genus *Pielus* is in part geographical. Whether it will be the best course to regard the *P. imperialis* as a geographical variety or as a species can only be decided after an examination of a large number of specimens, and perhaps after all it is not a matter of much importance.

In view of the interest which Mr. Lucas evidently takes in this particular group of moths, it is remarkable that he has not made himself acquainted with the sexual characters of the various species. Had he read the generic characters of *Pielus* as defined by Walker, Scott, and others, he would not have described a brick red moth with silver markings as the female of *P. hyalinatus*. It is well known that in the group of *Pielus* to which that species belongs the males have unipectinate antennæ, and the forewings provided with clearly defined white or silver markings; whereas the females have antennæ which to the naked eye appear moniliform, and forewings which are not provided with these distinctive markings.

Herrich-Schäffer's figure and that of *P. imperialis* represent males, and Mr. Lucas's specimens evidently belong to the same sex.

NEW SPECIES OF *LAMPYRIDÆ*, INCLUDING A NOTICE OF THE MT. WILSON FIRE-FLY.

BY A. SIDNEY OLLIFF, F.E.S.
ASSISTANT ZOOLOGIST, AUSTRALIAN MUSEUM.

The insects commonly known as fire-flies in Australia belong to the family Lampyridæ, and as I am not aware that any luminous species of Coleoptera belonging to other families have yet been discovered here, I believe to that family exclusively. Some authors who have treated of light-giving insects—as, for instance, the late Andrew Murray—confine the name fire-fly to the luminous Elateridæ or Click-beetles, and use the term glow-worm for the Lampyridæ; but as this is opposed to the practice of a large number of entomologists, and to the every-day habit of those who live in the localities where the insects are found, I do not propose to adopt the terms in this sense, especially as it appears to me a better course to apply the name fire-fly to winged forms of whatever family, and to confine the name glow-worm to those, whether larvæ or wingless females, which are found on the ground. The cause of the phosphorescence or luminosity which gives these insects their names was long wrapt in mystery, and many were the speculations indulged in by the older naturalists as to its use and origin. Nearly all recent writers, however, have agreed that the light which they emit is a means of attracting the sexes to each other; whence the oft-quoted lines applied by the poet Montgomery to the female glow-worm, which is said

> "To captivate her favourite fly,
> And tempt the rover through the dark."

From the labours of de Bellesme * and Wielowiejski, † with regard to the cause of the luminosity, it appears to be fairly

* Comp. Rend., xc., p. 318; also Ann. Mag. Nat. Hist. (5), v., p. 345 (1880).
† Z. Wiss. Zool. xxxvii. p. 354, (1882).

established that the light is produced by the slow oxidation or combustion of a substance supposed to be phosphoretted hydrogen, which is formed under the influence of the nervous system, and that the seat of light is the parenchymatous cells of the superficial layer of the light-organs, and not in the terminations of the tracheæ which thickly traverse them. These conclusions are borne out by the experiments of Emery,* who states that when the luminosity is only at half its full power the combustion is exclusively confined to these cells. It is only necessary to allude to the power possessed by these insects of extinguishing their light at will,† a power which they can only exercise for a short period, probably just so long as the air can be shut away from the abdominal light-organs; but I should like to add a few remarks concerning the external appearance of the light of the species here called *Atyphella lychnus*, which I had an opportunity of observing in the garden of Mr. E. C. Merewether when visiting Mt. Wilson in January last. At that time the insects were to be found in fair numbers on dark still evenings, and a beautiful sight they made, moving in lazy flight between the tree-ferns, their light alternately glowing and disappearing as they approached. This alternate emission and cessation of the phosphorescence appears to be characteristic of many species of Eastern fire-flies, and is supposed by von Siebold to coincide with the movements of inspiration and expiration. I observed that the gleams of light, both in flight and when the insect was at rest, lasted from about one-third to about two-thirds of a second, and that the intervals of darkness were of slightly longer duration; the light began as a feeble yellow glow, and gradually increased in intensity until it burst into a brilliant reddish-yellow flame. As I have said, the fire-flies were common during

* Bull. Soc. Ent. Ital., xviii., p. 351 (1885); also J. R. Micr. Soc. (2) vi. p. 234 (1886).

† The idea that the "source of light" is withdrawn from the external wall of the luminous parts during the interval of darkness, and pressed against it during the period of light, put forward by Gorham (Tr. Ent. Soc. Lond., 1880, p. 66), is, of course, a mere assumption, and is opposed to the structure of the light-organs.

my visit to Mt. Wilson, and I saw a considerable number of males flying together on more than one occasion, but I never saw the simultaneous cessation of light alluded to by many observers who have watched similar insect-swarms in South America and in the East.

The female of *Atyphella* is unfortunately unknown. It is, therefore, impossible at present to definitely decide upon the systematic position which the Mt. Wilson fire-fly should occupy. There are, as everybody knows, two groups of Lampyridæ which have the head hidden beneath the prothorax, one with the elytra (wing-covers) and wings present in both sexes, the other with the elytra absent or rudimentary and the wings wanting in the female. In structure the male of *Atyphella* approaches certain forms which belong to the latter of these groups, but from this fact we have no right to assume that the female is apterous, although it is probable that this is the case. It would be most interesting to know the truth, and also to learn if the female is luminous like the male. Who is there to settle these questions? It may be that the females are winged, and remain quietly concealed in the grass, or beneath the leaves of the surrounding foliage, whilst the males indulge in flight, like the European species *Luciola lusitanica*, Char., alluded to by Dr. Sharp,* but I do not think this likely.

A. *Head completely hidden beneath prothorax* (LAMPYRINÆ).

ATYPHELLA, gen. nov.

Elongate, sub-parallel. Head completely hidden by the prothorax, excavated between the eyes which are moderately large and prominent. Antennæ 11-jointed moderately robust, a little shorter than the prothorax, very slightly compressed, and somewhat narrowed at both extremities; the basal joint elongate, decidedly narrowed at the base, 2nd joint about half as long as the 1st, 3rd longer and narrower than 2nd, joints 4-10 gradually

* Ent. Mo. Mag., XVII., p. 69 (1880).

decreasing in length towards the extremity, and each slightly produced internally at the apex, terminal joint rather small, rounded anteriorly. Prothorax transverse, rounded in front, anterior margin strongly reflexed, the sides reflexed, sub-diaphanous; the posterior margin reflexed, bisinuate. Scutellum elongate, rounded behind. Elytra elongate, rounded behind, each with four moderately elevated costæ; the margins strongly reflexed; the suture raised. Abdomen flattened, the posterior angles of the segments acute; beneath the whole of the last two segments are luminous, the terminal one gently bisinuate at the posterior margin and slightly produced in the middle; on each side, beyond the sinuations, the segment is feebly emarginate. Pygidium rounded behind. Legs moderately long; tarsi with the 4th joint strongly bilobed.

I have convinced myself by a careful examination of the genitalia, under a lens of suitable power, that all the specimens to which I have been able to refer belong to the one sex, and that the male. Under these circumstances it is not possible to decide the exact position of the genus with any degree of certainty, but I have little doubt of its near affinity to *Diaphanes* and *Pyrocoelia*, both divisions which have been made at the expense of the old genus *Lampyris*. The three Australian species I here propose to distinguish under the name *Atyphella*, are not characterized by any single point of structure (except perhaps the comparative length and form of the antennal joints) separating them from the many divisions of the Lampyridæ, but they present certain features which in combination seem to preclude their finding a place in any of the existing groups. None of the joints of the antennæ are strongly serrate, as joints 3-10 are said to be in *Pyrocoelia*.

I may add that *Pyrocoelia bicolor*, Fabr.,* described from "Nova Cambria," and said also to occur in Java, is unknown to

* This species is omitted in Masters' Catalogue of Australian Coleoptera, apparently by an oversight, as it is included in that of Gemminger and von Harold. The synonymy is as follows:—*Lampyris bicolor*, Fabr.,

me. Were it not that more than one writer since the time of Fabricius has recorded its occurrence in Australia, I should have thought there was some error in regard to the locality. It may be worth mentioning, as showing how easily an important omission in a description may escape the attention of systematic writers, that although *Lampyris bicolor* was redescribed by Boisduval in 1835, and its identity determined by Motschulsky (who referred it to the genus *Cratomorphus*), Gorham (who included it in his genus *Pyrocoelia*), and E. Olivier, its measurement has nowhere been recorded; on this point the only information we have is contained in the original description of Fabricius, who says "*Magna in hoc genere (Lampyris).*"

ATYPHELLA LYCHNUS, sp.n.

♂ Elongate, pale fuscous, dusky testaceous at the sides, clothed with fine yellowish pubescence; prothorax coarsely and closely punctured, feebly bisinuate in front, and somewhat produced in the middle; each elytron with four conspicuous testaceous posteriorly abbreviated costæ.

Head excavated between the eyes; this excavation rugulose-punctate behind and at the sides, shining in the middle. Antennæ fuscous, moderately robust, 3rd joint elongate, decidedly narrowed at the base. Palpi testaceous. Prothorax broadly transverse, somewhat narrowed in front, moderately convex, fuscous, with the sides broadly testaceous, coarsely and closely rugulose-punctate; the anterior margin and sides strongly reflexed, the former gently bisinuate, and produced to an obtuse point in the middle; posterior margin strongly bisinuate, moderately strongly reflexed. Scutellum testaceous, finely and closely punctured. Elytra about four times as long as the prothorax, closely and moderately strongly rugulose-punctate, the suture and the narrow

Syst. El., II., p. 100 (1801); Boisd. Voy. Astrol., II., p. 129 (1835); *Cratomorphus bicolor*, Mots., Etud. Ent. p. 34 (1853); *Pyrocoelia bicolor*, Gorh., Trans. Ent. Soc. Lond. 1880, p. 91; E. Oliv., Notes Leyd. Mus., VIII., p. 199 (1886).

up-turned lateral margins testaceous, each with four slightly raised costæ which are abbreviated before the apex; interstices broad; the 1st and 2nd costæ united, or with a tendency to unite, posteriorly. Underside piceous, except the prosternum, mesosternum, and the sides of the metasternum, which are dusky-testaceous, and the last two abdominal segments and the genitalia, which are yellowish-white. Legs with the femora dusky testaceous; the tibiæ and tarsi pale fuscous. Length $6\frac{1}{2}$-$7\frac{1}{2}$ mm.

Mt. Wilson, Blue Mountains, N. S. Wales (3,478 feet), in January; and at Sydney, Kiama, &c.

♀ Unknown.

I think it probable that this particular fire-fly, or one of its allies, is the "New Holland Species," which Carus,* as long ago as 1824, stated, on the authority of Long, to be possessed of a light which varies in intensity in "rhythmical vibrations."

A single Lampyrid larva found by me at Mt. Wilson in January, under some decaying wood is probably the young of *A. lychnus.* When it was captured it was in a very torpid state and showed no sign of luminosity, but I am assured by Mr. J. D. Cox, a careful observer who has passed many summers at Mt. Wilson, that a larva which he has found on several occasions and always regarded as the larva of the fire-fly, is faintly but distinctly phosphorescent, the light being continuous and not intermittent like that of the perfect insect. A comparison of my specimen (which is briefly described below) with those obtained by Mr. Cox has convinced me of their identity, so to say the least the evidence is strongly in favour of the assumption that these larvæ are the early stage of *A. lychnus.* It will be for future observers to determine if this is really the case by rearing the mature insect from these luminous larvæ.

Larva of A. LYCHNUS (?): Elongate, flattened, much narrowed both in front and behind, piceous, somewhat shining; the 1st thoracic and the last three abdominal segments rusty brown; the

* Oken's Isis, II., p. 245.

intervening segments with two rows of inconspicuous reddish testaceous markings, one on each side of the middle; all segments (except the last) lobed at the sides and provided with a rather strongly impressed median channel, the edges of which are slightly raised; the margins very finely serrate.

Head completely hidden beneath the prothorax, corneous, narrowed and truncate in front; a large prominent ocellus on each side. Antennæ rather long, somewhat flattened, robust, placed at the sides of the head, 4-jointed, the 1st joint long, 2nd much shorter, slightly narrowed at the base, 3rd about twice as long as the 2nd, obliquely truncate at the extremity, 4th very minute, inserted in a groove at apex of 3rd near the internal angle. Mandibles prominent, falciform, and simple. Maxillæ elongate. Maxillary palpi short, robust, composed of three joints which gradually decrease in width towards the apex. Labial palpi 2-jointed, minute. Near the base of each maxillary palpus is a minute apparently 2-jointed appendage.* First thoracic segment at the base about one-third broader than long, greatly narrowed in front; the anterior margin arched, strongly reflexed, slightly emarginate in the middle; the sides strongly reflexed, slightly sinuate on each side just behind the anterior angles, which are not very prominent; 2nd and 3rd thoracic segments short, about three times as broad as long, the sides reflexed, the angles rounded. Abdominal segments gradually narrowed to the apex, 1-7 like the segments of the thorax, 8th emarginate behind, 9th much narrower than the preceding, truncate. Beneath exceedingly finely granulate, the 1st to 7th abdominal segments provided on each side with a deeply impressed line, dividing the outer plate-like portions from the middle of the segments. Stigmata nine pairs, two pairs placed on tubercles upon the meso- and meta-thoracic segments respectively, and seven upon tubercles within the plate-like divisions on the first seven segments of the abdomen. Legs rather short; claws simple. Length $9\frac{1}{2}$ mm.

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* As I have no specimen for dissection I am not able to describe the mouth-structure as accurately as I could wish.

This larva bears some resemblance to that of *Photuris congrua*, Chevr., described at considerable length by Chapuis (Hist. Mét. Col. Exot. p. 35, pl. 3, fig. 3, 1861), but the head is completely hidden when viewed from above, and the segments of the thorax (except the first) and body are more strongly lobed externally The three terminal segments of the latter are testaceous in colour, and probably it is from these that the phosphorescent light alluded to above will be found to proceed.

Atyphella scintillans, sp.n.

♂ Elongate, dark fuscous, sparingly clothed with fine yellowish pubescence, prothorax coarsely and rather closely punctured, very feebly bisinuate in front, scarcely at all produced in the middle, with a median line on the disc; each elytron with four posteriorly abbreviated costæ.

Head very strongly excavated between the eyes; the excavation shining, finely punctured at the sides, with an obscure median ridge. Antennæ like those of *A. lychnus*, except that the terminal joint is a little larger. Prothorax moderately convex, fuscous, with the sides broadly testaceous, strongly and closely rugulose-punctate, with a distinct median line which is effaced both in front and behind; the anterior margin and sides moderately strongly reflexed, the former very feebly bisinuate, and slightly produced in the middle; posterior margin strongly bisinuate, moderately strongly reflexed. Scutellum testaceous, finely and closely punctured. Elytra very closely and moderately strongly rugulose-punctate, each with four costæ which are effaced posteriorly before reaching the apex, the interstices broad. Underside piceous, except the prosternum, mesosternum, and the sides of the metasternum which are dusky testaceous, and the genitalia and last two abdominal segments, which are yellowish white. Legs reddish testaceous, tibiæ darker. Length 7⅓-8½ mm.

Upper Hunter River, and Newcastle, New South Wales.

♀ Unknown.

The ample and regularly rounded prothorax with its distinct median impression, and the deeply excavated head, are characters which combined with the form of the elytral costæ and its different colour, will at once distinguish this insect from the preceding species.

ATYPHELLA FLAMMANS, sp.n.

♂ Elongate-ovate, fuscous, clothed with very fine yellowish pubescence; prothorax pale testaceous, coarsely and closely punctured, with a large discal black marking very feebly bisinuate in front; elytra with the margins broadly testaceous, each with four posteriorly abbreviated costæ, the 1st and 2nd conspicuously testaceous, the 3rd faintly testaceous, the 4th within the testaceous margin.

Head strongly excavated between the eyes, with a feeble elevation in front; the excavation shining, very finely rugulose-punctate at the sides. Antennæ fuscous, like those of *A. lychnus*, but with joints 4-10 proportionately longer. Palpi fuscous. Prothorax broadly transverse, rather strongly convex, with a large central black marking which is attenuated to a point behind; the anterior margin and the sides strongly reflexed, the former very feeble bisinuate and slightly produced in the middle. Scutellum pale testaceous, closely and rather finely punctured. Elytra closely and moderately strongly rugulose-punctate, the suture testaceous and distinctly raised, the 1st and 2nd costæ strongly elevated, reaching to just before the apex, the 3rd feebly elevated, effaced near the base, and abbreviated at about $\frac{2}{3}$ of the length of the elytra, the 4th costa rather feebly elevated, extending as far as the 1st and 2nd, the interstices broad. Underside dark piceous; the prosternum, mesosternum, and the sides of the metasternum dusky testaceous; the last two abdominal segments and the genitalia yellowish white. Legs fuscous; femora reddish testaceous. Length 9-10 mm.

Cloncurry, Queensland.

♀ Unknown.

This species is conspicuous by the striped appearance of its elytra, and the black patch on its prothorax.

B. *Head received into, but not hidden by prothorax* (LUCIOLINÆ).

LUCIOLA PUDICA, sp.n.

Dark reddish fuscous, finely pubescent; head black; prothorax, scutellum, sterna, and legs (except the tibiæ and tarsi) reddish testaceous; abdomen bright yellow.

Head deeply excavated between the eyes; the excavation finely punctured, shining. Antennæ rather long, pubescent, the first two joints black, the others dark fuscous. Prothorax transverse, nearly quadrangular, finely and moderately closely punctured; feebly bisinuate both in front and behind; the anterior margin and the sides strongly, and the posterior margin moderately strongly reflexed, the former impressed on each side behind the upturned portion; an uninterrupted median line, and an indistinct impression on each side just behind the middle. Scutellum finely punctured. Elytra finely rugulose-punctate, the pubescence short and fine, closer than that of the prothorax, the suture slightly elevated, no distinct costæ, a faint indication of one near the base. Underside clear reddish testaceous; abdominal segments yellow, the apical one produced to a point in the middle, slightly sinuate on each side. Legs pale reddish testaceous; tibiæ darker, inclining to fuscous especially externally; tarsi fuscous. Length $6\frac{1}{2}$-8 mm.

Bowen, Queensland; New South Wales (A.M.).

I have examined six or eight specimens, all of which I believe to be males on account of the pointed form of the last abdominal segment; the species is evidently an ally of *Luciola antennata*, E. Oliv.,* and *L. australis*, Fabr., but it is much smaller than the measurement indicated by Boisduval beside his very indifferent figure of the latter.

Two other species of the genus *Luciola* are known to me—the *L. flavicollis*, Macl., and what I regard as the *L. dejeani*, Gem., (*apicalis*, Boisd.), but as the single line of description submitted

* Ann. Mus. Genov. xxii. p. 365, pl. 5, fig. 8 (1885).

as the diagnosis of *L. apicalis* by its founder is quite inadequate for the determination of a species in this or any other group, I am in some doubt as to the correctness of my conclusion. The only specimen I have seen was obtained during Sir T. L. Mitchell's Victoria River Expedition, but in what locality I have no knowledge. It is luteous, measures 9 mm. in length, and is unusually robust, the elytra being nearly 4 mm. in width at their middle; the head is black, the elytra (which have faint indications of four costæ) pitchy at the apex; beneath the last two segments are yellowish-white (apical one rounded behind, very slightly produced in the middle), the preceding segment margined with piceous posteriorly; tarsi and tips of the tibiæ fuscous.

L. flavicollis has well marked sexual characters which may be defined as follows:—

♂ Abdomen with penultimate segment and a semicircular basal spot on apical segment luminous; the apical segment deeply emarginate on each side, very strongly produced between the emarginations, the produced portion with nearly parallel sides, the apex feebly emarginate. Eyes very large.

♀ Abdomen with penultimate segment luminous, apical segment feebly emarginate in the middle; small supplementary segment rounded behind, complete. Eyes moderately large.

By the light of additional material which I have seen from Rockhampton and Port Curtis, Queensland, I am in a position to affirm that the suture in this species, like the sides, is luteous to within a short distance of the apex.

I am informed by those who are acquainted with the haunts of *L. flavicollis* that its light is intermittent.

"Feuille des Jeunes Naturalistes." No. 226 (August, 1889). *From the Editor.*

"Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino." Vol. IV., Nos. 62-66 (1889). *From the Museum.*

"Crustacea Neerlandica.—Part iii. Isopoda;" "Isopodes Terrestres recueillis aux Açores en 1887-89," et "Liste Supplémentaire." Also, three other Pamphlets. Par Adrien Dollfus. *From the Author.*

A Pamphlet entitled "Sur un appareil nouveau pour le Recherche des Organismes pélagiques a des profundeurs déterminées." Par le Prince Albert de Monaco. *From the Author.*

"Victoria.—Report of Royal Commission to inquire into and report upon the Sanitary Condition of Melbourne." Two parts (1889). *From the Commission.*

"Memoria del Directorio del Banco Agrícola—Comercial del Rio de la Plata, &c." *From the Consul of the Argentine Republic, Sydney.*

"Results of Rain, River, and Evaporation Observations made in N.S.W. during 1888;" Four Pamphlets from the "Journal and Proceedings of the Royal Society of N.S.W." for 1888 and 1889. By H. C. Russell, B.A., F.R.S., &c. *From the Government Astronomer.*

"Johns Hopkins University Circulars." Vol. VIII., No. 74 (1889). *From the University.*

"The American Naturalist." Vol. XXIII., No. 268 (April, 1889). *From the Editors.*

"Royal Dublin Society.—Scientific Transactions." Series ii., Vol. IV., Nos. 2-5 (1889); "Scientific Proceedings." n.s. Vol. VI., Parts 3-6 (1888-89). *From the Society.*

'New South Wales; Royal Commission—Conservation of Water, Diagrams and Plans to accompany the Third and Final Report of the Commissioners." *From the Secretary for Mines.*

"Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia." 4th Session (1888-89), Vol. IV. *From the Society.*

"The Quarterly Journal of the Geological Society of London." Vol. XLV., Part 3 (No. 179), 1889. *From the Society.*

A Pamphlet entitled "Musical Sand." By Cecil Carus-Wilson, F.G.S., &c. *From A. Sidney Olliff, Esq., F.E.S.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 45 (Sept., 1889). *From the Editor.*

"Victoria.—Annual Report of the Secretary for Mines, 1888." *From the Secretary for Mines.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CVIII., No. 25; CIX., Nos. 1-3 (1889). *From the Academy.*

"The Victorian Naturalist." Vol. VI., No. 5 (September, 1889). *From the Field Naturalists' Club of Victoria.*

"Journal of the Linnean Society of London.—Botany." Vols. XXIII. (Nos. 156-157); XXIV. (Nos. 163-164); XXV. (Nos. 165-170); XXVI. (No. 173), 1888-89; "Zoology." Vols. XX. (Nos. 119-121); XXI. (No. 132); XXII. (No. 140), 1888-89; "General Index to the first twenty Volumes of the Journal (Botany);" "List of Members, Session 1888-89." *From the Society.*

"Catalogue of the Fossil Reptilia and Amphibia in the British Museum (Nat. Hist.)." Part II. (1889). By R. Lydekker, B.A., F.G.S., &c. *From the Trustees.*

PAPERS READ.

DESCRIPTIONS OF TWO NEW SPECIES OF AUSTRALIAN MOLLUSCA.

BY JAMES C. COX, M.D., F.L.S.

ANCYLUS SMITHII, sp.nov.

(Pl. XIX., figs. 1-3).

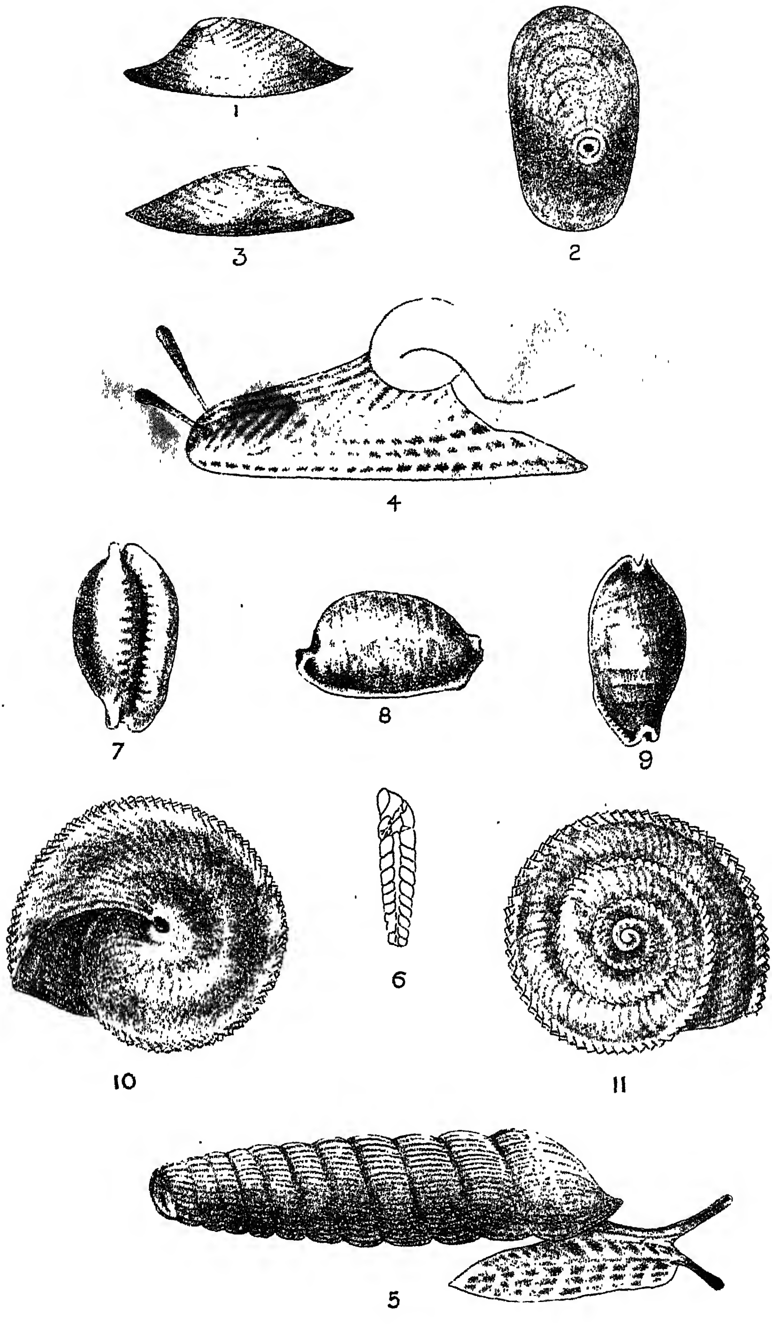
Shell ovate, broadest in front, pale horny yellowish-green colour, translucent, limpet-shaped; striated concentrically from apex to circumference with curved lines of growth, the apex being the centre of the rays; striated longitudinally with striæ radiating from the apex in rather coarse ridges, which are for the most part rather widely separated, but are irregular in distance from each other, and if anything interrupted in their direct course, and are not quite straight. The lines are undoubtedly slightly waved. These can only be seen with a moderately high power. These striæ can be seen through the shell when the animal is removed.

The apex is bluntly rounded, inclined to the right, and the shell declines from it less abruptly in front than it does behind and at the sides, where it gradually tapers off, and is situated $3\frac{1}{4}$ millimètres from the anterior margin. The shell, looked at from the inside, shows the muscular impression, which is rather large and granular.

When the animal is in the shell a brownish colour is seen opposite the muscular impression.

Dimensions of full-grown shell—length 5; breadth (at anterior end) 3, (at posterior end) 2; height $1\frac{1}{2}$ millimètres.

The living specimens of this Ancylus or River Limpet now described, and which were exhibited at the last meeting of the Society, were obtained by me from the Port Hacking River, National Park, about twenty miles south of Sydney, quite unexpectedly, and they have bred and multiplied themselves to a very arge number.



[illegible] & Henderson, Litho., Sydney

About nine months ago I lifted from the bed of the river, at its head, specimens of *Vallisneria* and other aquatic plants, to the roots of which I found wire worms (*Gordius* sp.) adhering in great numbers. Being anxious to observe the habits of life of these worms, I placed the plants in a fish globe by themselves and covered their roots with earth. A few weeks afterwards I was surprised to observe in the globe the presence of several specimens of Ancylus in a living state, and I had them carefully cared for. The result has been that there are now in the globe at least forty specimens. As a rule they reside at the bottom of the globe, or as high up in it as the earth covering the roots of the plants reaches, but a few are seen moving about a few inches higher up adhering to the glass.

A species of this genus has been described by Prof. Tate from North Australia and the River Torrens, Adelaide, as *Ancylus Australicus* (Trans. and Proc. Roy. Soc. South Australia, Vol. III. 1880, p. 102).

The genus *Ancylus* proper has its summit apex turned to the left. There are six sub-genera recognised under the genus—*Ancylastrum, Acroloxus, Cumingia, Haldemania, Lanx,* and *Brondelia,* but the only one I can recognise with a dextral apex is *Ancylastrum.*

As the shell which I now describe is undoubtedly dextral, I conclude that it belongs to this sub-genus.

Cypræa Irvineanæ, sp.nov.

(Pl. xix., figs. 7-9).

Shell umbilicated, oblong-ovate; pale cream-coloured, irregularly sparsely spotted with minute pale yellowish-red spots; these spots have as a rule a transverse elongated form very similar to *Cypræa Coffea,* Sowb.; subfasciate by depth of colour on the dorsal aspect, and crossed transversely by subangulate ridges which divide the dorsum into about six unequal parts. The dorsal surface is well elevated, the sides being steep; the right margin is crenately grooved from end to end, the left well grooved or sulcated in front and only slightly posteriorly, the

intermediate portion of the side being quite free from sulcation. The margin of the right side of the shell is blunt, well-defined, and everted, separating the dorsal and ventral surfaces, and runs forwards and backwards, joining the everted extremities. The teeth of the orifice, from 16 to 18 in number, are white, sharp, and prominent, but not coarse on the right side, and only extend about half-way across the right callous base; on the left the teeth, about 15 in number, are small and fine, scarcely extending at all across the left side of the base, but are seen as callosities dipping into the internal stoma.

The channel is well everted. There are no decided colour-markings on each side of it in front, merely a light brown coloration blotch, and a similar faint coloration blotch is noticeable on the sides of the posterior ends. There is a faint freckling of coloration along the everted edges of the sides within the sulcation of the margin; the rim margin is inclined to be tuberculously elevated. The interior of the shell is of a very pale flesh tint.

Length 25, breadth 14 millimètres.

Hab.—North-west coast of Australia.

Cypræa stolida, Linn., with its variety *C. brevidentata*, Sowb., and *C. Coffea*, with which this species would group, are found at the same locality, but it has such distinct differences as to justify its being made a new species.

I have named this shell after Mrs. J. F. Irvine, an enthusiastic conchological collector, who obtained it at Cape Naturaliste, in Western Australia, along with many other valuable species new to science

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EXPLANATION OF PLATE.

Figs. 1-3.—*Ancylus Smithi*, Cox (× 6).
Fig. 4.—*Cœliaxis australis*, Forbes; the animal.
Fig. 5.—*Cœliaxis australis*, Forbes; animal and shell (enlarged).
Fig. 6.—*Cœliaxis australis*, Forbes; section.
Figs. 7-9.—*Cypræa Irvineanæ*, Cox.
Figs. 10-11.—*Helix Howe-insulæ*, Cox.

Note.—Figures 4-6, and 10-11 refer to species to be treated of in a future paper.

REVISION OF THE GENUS *HETERONYX*, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem. Linn. Soc. N.S.W.

Part IV.

The present memoir carries on my revision of *Heteronyx* to the end of the genus. In order to make this portion (Part IV.) of the work as far as possible complete in itself in respect of the species it deals with, I must remind the members of the Linnean Society that for the purpose of my work I have proposed to divide *Heteronyx* into 3 main divisions (or "Sections"), the 1st containing those species in which the labrum is altogether below the plane of the clypeus and invisible from above (as in most *Melolonthidæ*) ; the 3rd containing those species in which the labrum is dilated and directed upwards in such manner that its summit rises above the plane of the clypeus ; and the 2nd containing species in which the relation of labrum and clypeus is intermediate between those indicated above. I have now to deal with the last part of the 3rd Section. I subdivided it into groups of species having 8-jointed antennæ (already dealt with), and those having 9-jointed antennæ. The latter of these groups I have subdivided according as the claws are bifid (already dealt with) or appendiculate. The present memoir deals with those species whose claws are of the last-named form.

In the course of a few months I hope to be able to offer to the Society an appendix treating of a number of species that have come into my hands during the issue of this "Revision" but too late to be included in the sections to which they belong, and also discussing those species previously described by other authors which I have failed to identify.

Tabulation of species of Section III., Group II., Sub-group II. (*i.e.*, having the labrum overtopping the plane of the clypeus, the antennæ 9-jointed, and the claws appendiculate).

A. Head and prothorax densely clothed with long erect hairs..................

B. Elytra at most feebly costate, the intervals appearing like obscure striæ ....

C. Puncturation of head behind not fine and sparing in contrast to that of clypeus.......................

D. Puncturation of prothorax fine and close, almost confluent............

E. Club of antennæ black or pitchy.

F. Hind angles of prothorax from some points of view quite distinct .... *jubatus*, Blackb.

FF. Hind angles of prothorax quite rounded off, non-existent....... *fallax*, Blackb.

EE. Club of antennæ testaceous... .. *fraternus*, Blackb.

DD. Puncturation of prothorax coarse and sparse........................ *hirtuosus*, Blackb.

CC. Puncturation of head behind fine and sparse in contrast to that of clypeus...........................**dimidiatus*, Er.

BB. Elytra deeply striate..................**striatipennis*, Blanch.

AA. Head and prothorax not densely clothed with long erect hairs.......

* The characters of these species are derived from the published descriptions, types not having been examined by the author of the present memoir.

B.*Suture between the metasternum and its episterna very evidently (say by at least $\frac{1}{4}$ of its length) longer than the distance from the hind apex of that suture to the hind margin of the hind coxæ........................

C. Puncturation of prothorax and elytra somewhat even,—or that of the former coarser and less close......

D. Apical piece of hind claws considerably shorter than the basal piece.

E. Hind claws normal in length (*i.e.*, at most little more than half as long as the rest of the claw joint.

F. Puncturation of prothorax not conspicuously coarser and stronger than of elytra.........

G. Puncturation of elytra fine and squamose (colour ferruginous).

H. Posterior angles of prothorax quite rounded off............. *vacuus*, Blackb.

HH. Posterior angles of prothorax (from a certain point of view) appearing sharp and hindward directed.... ...... *simius*, Blackb.

GG. Puncturation of elytra coarse and not squamose (colour dark ferruginous). .... *rusticus*, Blackb.

GGG. Puncturation of elytra coarse and squamose (colour black) *nigrinus*, Blackb.

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* The following species seems to oscillate between this and "BB,"—*lubricus*, Blackb.

FF. Puncturation of prothorax conspicuously coarser and stronger than of elytra.................... *oscillator*, Blackb.

EE. Hind claws long (much more than half as long as the rest of the claw joint)......... .... *rapax*, Blackb.

DD. Apical piece of hind claws little, or not, shorter than basal piece.

E. Hind angles of prothorax quite rounded off........................ *lubricus*, Blackb.

EE. Hind angles of prothorax (at least from some point of view) well developed....... ....

F. Prothorax with middle lobe of base scarcely indicated......... *montanus*, Blackb.

FF. Prothorax with middle lobe of base well defined.............. *concolor*, Macl.

CC. Puncturation of prothorax (at any rate in front) much closer and finer than of elytra................

D. Puncturation of prothorax much closer and finer anteriorly than behind .... *Rothei*, Blackb.

DD. Puncturation of prothorax close, fine, and even throughout....... *puncticollis*, Blackb.

BB. Suture between the metasternum and its episterna little, or not, longer than the distance from the hind apex of that suture to the hind margin of the hind coxæ.....

C. Puncturation, at least of prothorax and elytra, close, fine, and even

(more or less after the manner of that of *H. piceus, horridus, normalis*, &c.) ....

D.*Elytra without rows of setiferous granules,—at most a few such granules close to the base..........

E. Inner apex of each elytron not bearing a conspicuous tuft of setæ..................................

F. Trilobed appearance of outline of head quite defined...............

G. Basal joint of hind tarsi shorter than the 2nd joint.............

H. Middle lobe of "trilobed outline" of head appears narrower than the lateral lobes.

I. Puncturation of elytra very fine and close (evidently more so than in *H. piceus, horridus* and *normalis*).....

J. Species at least 5 lines long, —not of a distinctively "orange" colour...........

K. Elytra much wider behind the middle than at the middle .... *agrestis*, Burm.

KK. Elytra scarcely if at all wider behind the middle than at the middle...... *scalptus*, Blackb.

JJ. Species about 4 lines long, —colour bright orange... *doctus*, Blackb.

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* *Vide* note on *H. rhinastus* (p. 689).

II. Puncturation of elytra less fine and close (resembling that of *H. piceus, horridus* and *normalis*).............. *rhinastus*, Blackb.

HH. Middle lobe of "trilobed outline" of head appears wider than the lateral lobes...... *laminatus*, Blackb.

GG. Basal joint of hind tarsi not shorter than the second joint. *subferrugineus*, Burm.

FF. Trilobed appearance of outline of head not from any point of view defined................. *peregrinus*, Blackb.

EE. Inner apex of each elytron bearing a conspicuous tuft of setæ. *elongatus*, Blanch.

DD. Elytra with rows of setiferous granules, especially a row along the suture......................... *pustulosus*, Blackb.

CC. Puncturation of prothorax and elytra very evidently less close, fine, and even than in the group "C"................................

D. Trilobed outline of head with the middle lobe evidently more than half as wide as the lateral lobes.

E. General colour more or less uniform, —some shade of ferruginous or testaceous ....

F. Apical membrane of elytra not extraordinarily developed......

G. Hind coxæ on the external margin much shorter than the distance from their hind margin to the hind margin of the 3rd ventral segment..........

H. Apical part of suture of elytra on either side keel-like,—the apex itself prominent or subspiniform .... *longulus*, Blackb.

HH. Suture of elytra very slightly convex,—at apex not at all produced or subspiniform..........................

I. Colour of elytra dull brownish yellow without any ferruginous tone................... *flavus*, Blackb.

II. Colour of elytra of a decidedly ferruginous tone............ *angustus*, Blackb.

GG. Hind coxæ on external margin scarcely if at all shorter than the distance from their hind margin to the hind margin of the 3rd ventral segment.

H. Basal joint of hind tarsi evidently longer than the 2nd joint .... *scutatus*, Macl.

HH. Basal joint of hind tarsi not longer than the 2nd joint. *collaris*, Blackb.

FF. Apical membrane of elytra extraordinarily developed....... *posticalis*, Blackb.

EE. General colour not uniform,—partly black or pitchy.........

F. Upper surface with a velvety appearance, and pruinose...... *iridiventris*, Blackb.

FF. Upper surface glabrous (or nearly so) and nitid........... *marginatus*, Blackb.

DD. Trilobed outline of head very well developed, with the middle not

more than half as wide as the lateral lobes........................

E. Prothorax feebly (at most) lobed hindward.........···...............

F. Prothorax considerably narrowed in front; elytra set with numerous long erect hairs among the adpressed pubescence.......... *vagans*, Blackb.

FF. Prothorax very little narrowed in front; elytra not set with numerous long erect hairs ... *mimus*, Blackb.

EE. Prothorax very strongly lobed hindward, — not much less strongly than in *H. lobatus*, Blackb.... .... *castaneus*, Macl.

H. DIMIDIATUS, Er.

I do not think that I have seen an example of this insect, which is said to occur in Tasmania, and is probably limited to that island. The following five species are all closely allied to it in having the anterior half or thereabouts of the upper surface clothed with long erect hairs, the head and prothorax ordinarily black or pitchy and the elytra usually ferruginous with more or less dark colouring in front, and the elevation of the labrum above the clypeus usually very slight. The greater part of Erichson's description would apply to nearly all the species known to me of this group, but it mentions one character which seems to differentiate *dimidiatus* strongly, viz., "fronte parce subtiliter punctata," as contrasted with "clypeo punctato-rugoso." No species that I have seen in the group shows any indication of this sculpture. As Erichson gives no exact description of the claws or of the relative length of the hind coxæ and metasternum it is of course not certain that *H. dimidiatus* would fall in this group

(according to my arrangement) but it is hardly likely to differ in these respects from species evidently allied to it and themselves having these parts very uniform. It may be added that Erichson does not indicate the number of joints in the antennæ of *H. dimidiatus* except by implication in calling it a *Silopa*,—and he has certainly included *some* species with 8-jointed antennæ under the name, although in the generic diagnosis he calls the antennæ 9-jointed.

H. JUBATUS, sp.nov.

Minus elongatus; postice vix dilatatus; minus nitidus; pilis (antice longis erectis, postice brevioribus adpressis), sat dense vestitus; piceo-niger; palpis, elytris (basi minus late picea excepta), tarsisque, rufo-ferrugineis; abdomine tibiisque plus minus rufescentibus; capite crebre rugulose (clypeo parum subtilius crebrius), prothorace elytrisque crebre subtilius, pygidio leviter obscure, punctulatis; labro clypeum vix superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali parum longiori; coxis posticis metasterno manifeste, nec multo, brevioribus; elytris substriatis, interstitiis obsolete convexis. [Long. 3, lat. 1½ lines.

Var. A. Pedibus plus minus testaceis, colore obscuro in elytrorum sutura et marginibus lateralibus plus minus producto.

Var. B. Elytris antice haud obscurioribus.

Var. C. Capite (palpis rufis exceptis) corporeque subtus antice, solis piceis.

The "trilobed" appearance of the front outline of the head is not well defined from any point of view as it is in itself very feeble, and viewed from the most favourable point is much concealed by the long erect hairs of the surface; its appearance from the most favorable point of view is that of a feeble bisinuate line bulging out feebly and very narrowly in the middle. The clypeus is strongly reflexed at the sides, very distinctly margined across the front, feebly concave in front, its sides scarcely angulated immediately in front of the eyes, its sculpture scarcely so coarse as

that of the rest of the head, which does not form an evenly continuous plane with it and is separated from it by a strongly impressed suture angulated in the middle and wavy towards the sides. The prothorax is half again as wide as long, its base half again as wide as its front which is sub-bisinuate with sharp feebly produced angles; its sides are feebly arched, and most divergent immediately in front of the base, its hind angles very feeble but appearing from a certain point of view not quite rounded off, its base feebly bisinuate but strongly lobed hindward all across, and still more in the middle (somewhat as in *H. gracilipes*, mihi). The elytra are very feebly and widely but somewhat uniformly costate (somewhat as in *H. potens*, mihi), their lateral fringe being normal and their apical membrane obsolete. The hind coxæ are much nearer the length of the metasternum (than which they are not much shorter) than of the 2nd ventral segment. The metasternum is punctured somewhat closely and evenly but not at all coarsely, and is clothed with very long hairs; the hind coxæ are punctured unevenly (in parts very coarsely) and have an irregular antero-internal space smooth. The ventral segments are punctured somewhat coarsely at the sides, but neither closely nor deeply, the puncturation becoming more or less obsolete in the middle, where however some more or less conspicuous longitudinal impressions or scratches may be noticed on some of the segments. The ventral series are but little conspicuous. The hind femora are not much wider than the intermediate, their inner apical angle feeble but quite distinct. The lower two teeth on the anterior tibiæ are strong and sharp, the uppermost being less than half as large as the 2nd, the tibial outline straight from its base to the apex of the uppermost tooth. The hind claws (including the apical piece) are somewhat strongly compressed, their basal piece not much longer than the apical and having its inner apex but little produced. The whole undersurface is minutely coriaceous and therefore sub-opaque. The 2nd joint of the hind tarsi is half again as long as the 1st. Not closely resembling any of the preceding species, but perhaps nearest to *H. potens* and its allies. The puncturation of the upper surface is not unlike that of *H. piceus*,

Blanch. The punctures on the prothorax are spaced so that more than 20 averagely separated would range down the middle line.

It is not impossible that this is *H. striatipennis*, Blanch., (from Tasmania), but the expression "elytris profunde striatis" of that author would be so outrageously exaggerated if applied to this species that in the absence of Tasmanian examples I think it more likely that the two are distinct.

Apparently occurring, not rarely, all over Southern Australia; I have not seen examples from Western Australia, Queensland, or Tasmania.

H. HIRTUOSUS, sp.nov.

Minus elongatus; postice leviter dilatatus; sat nitidus; pilis fulvis antice longis curvatis erectis, postice minus longis depressis, sat dense vestitus; piceo-niger; antennis, palpis, pedibus, elytris, et abdominis apice, plus minus rufis; capite obscure crassissime vix fortiter, prothorace profunde sat crebre, elytris squamose sat crasse fortius nec crebre, pygidio fortius crebrius, punctulatis; labro clypeum vix superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali vix longiori; coxis posticis metasterno manifeste nec multo brevioribus; elytris vix striatis. [Long. $2\frac{2}{5}$, lat. $1\frac{1}{5}$ lines.

Var. A. Prothorace, pedibus totis, et abdomine toto, ferrugineis.

Var. B. Elytris antice, et abdomine toto, piceis. (Long. $3\frac{1}{5}$ lines).

Var. C. Elytris totis (macula ferruginea obscura latera versus excepta), et abdomine toto, piceis. (Long. 3 lines).

The detailed description of *H. jubatus* is applicable to this species with the following exceptions;—the clypeal suture is less strongly angulated in the middle,—the prothorax is somewhat less than half again as wide as long and has more strongly rounded sides which reach their greatest divergence further from the base, the base moreover being less lobed hindward,—the elytra have no (or scarcely any) indication of striæ,—the hind coxæ are slightly

shorter in proportion to the metasternum and 2nd ventral segment,—the undersurface is not coriaceous and is therefore more nitid,—the puncturation of the metasternum is stronger and of the hind coxæ less coarse,—the ventral segments are much more strongly punctured (especially in the middle). The hind tarsi are short as compared with those of the preceding and following species.

It will be seen by the Latin diagnosis that the whole upper surface is very much more strongly punctured than in *H. jubatus*. The punctures on the prothorax are spaced so that about 16 or 17 averagely separated would range down the middle line.

Also distributed widely in Southern Australia, but appears to be less common than *H. jubatus*.

H. FALLAX, sp.nov.

Minus elongatus; postice leviter dilatatus; sat nitidus; pilis antice longis erectis, postice suberectis sat brevibus, vestitus; piceo-niger; palpis, tibiis, tarsis, et elytris (parte antica excepta), ferrugineis; capite prothoraceque leviter sat crebre minus subtiliter, elytris (his obscure striatis) squamose sat crebre subrugulose, pygidio sparsim subtilius, punctulatis; labro clypeum vix superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali vix longiori; coxis posticis metasterno manifeste nec multo brevioribus. [Long. $2\frac{4}{5}$, lat. $1\frac{2}{5}$ lines.

Very like *H. jubatus*, the detailed description of which will apply to this species subject to the following remarks: the trilobed appearance of the front outline of the head is quite obsolete from all points of view; owing to the very slight elevation of the labrum above the clypeus (it does not rise at all above the *reflexed margin* of the front of the latter) it is quite invisible unless inspected from a point whence the view is so little oblique that the apparent continuity of the outline of the labrum and clypeus is lost; there is no defined difference in sculpture between the clypeus and the rest of the head; the hind angles of the prothorax are completely

rounded off so that the sides become the base without any indication whatever from any point of view of any exact point where they do so; the base of the prothorax is not bisinuate and is evenly and strongly lobed hindward all across; the puncturation of the head and prothorax is scarcely coarser but a little less strongly impressed than in *H. jubatus*; the hind coxæ are less coarsely punctured; the ventral series are probably more conspicuous (in the example before me they are rubbed off and I judge only from the punctures that have borne them).

This is the insect which Sir William Macleay regards as *H. dimidiatus*, Er., but the puncturation of the head is not consistent with that determination; moreover Erichson says of the prothorax "angulis posterioribus obtusis," whereas in this species there are no angles at all.

N. S. Wales.

H. FRATERNUS, sp.nov.

Minus elongatus; postice vix dilatatus; minus nitidus; pilis (antice longis erectis, postice brevioribus adpressis) sat dense vestitus; piceo-niger; palpis, antennis, tarsis, elytrisque, rufo-testaceis; capite æqualiter rugulose sat crebre, prothorace et elytris confertim subtiliter, pygidio obscure, punctulatis; labro clypeum late sat fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali parum longiori; coxis posticis metasterno haud brevioribus.

[Long. $2\frac{3}{5}$, lat. $1\frac{2}{5}$ lines.

So closely allied to *H. jubatus* that the detailed description of that species may be taken as referring to the present one with the following qualifications;—the labrum is more prominent, and the sides of the clypeus are less-reflexed and less produced forward so that in the "trilobed outline" of the head there is a very slight concavity between the lobes, and the appearance is rather that of a continuous curve much more strongly convex in the middle than at the sides, this more strongly convex piece (the middle lobe) being much more than half as wide as the lateral lobes. The puncturation of the upper surface is much finer and closer than in

H. jubatus, being indeed as fine and close as it well could be,—almost more so than in *H. pustulosus*, the elytra have scarcely a trace of striæ, the hind coxæ are distinctly longer than the metasternum, the hind femora are wider with their inner apical angle less marked, the longitudinal impressions on the ventral segments are wanting, and the undersurface is more shining.

A single example was taken near Port Lincoln by Mr J. Anderson.

H. VACUUS, sp.nov.

Minus elongatus; postice leviter dilatatus; subnitidus; ferrugineus; pilis aureis adpressis minus crebre vestitus; clypeo crebre fortiter rugulose, capite postice paullo sparsius crassius (huic et illo pube densiori suberecta), prothorace subtiliter minus crebre, elytris subtiliter squamose, pygidio obscure (nonnullis exemplis fortius) punctulatis; labro clypeum late minus fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali sat longiori; coxis posticis metasterno sat brevioribus. [Long. $3\frac{2}{5}$, lat. $1\frac{4}{5}$ lines (vix).

The "trilobed" appearance of the head is not from any point of view very well defined owing to the slight convexity of the upper outline of the labrum, and the feeble emargination of the clypeus (which, however, is margined all across); hence the middle lobe appears much more than half as wide as the lateral ones, and all appear but little prominent. The clypeus is fairly distinct from the rest of the head, with a feebly arched suture and puncturation evidently closer and less coarse. The prothorax is slightly more than half again as wide as long, the base slightly more than half again as wide as the front which is only moderately concave, with angles sharp but not very prominent; the sides are strongly rounded, the hind angles quite rounded off, the base only feebly bisinuate but rather strongly lobed hindward. The elytra are punctured somewhat as in *H. punctipennis* and *Mulwalensis*, but decidedly less closely than in either; their puncturation is very much closer, finer, and more squamose than in *H. aphodioides*; their lateral fringe is normal, their apical membrane distinct.

The hind coxæ are a little longer than the 2nd ventral segment and are punctured sparingly and strongly but with a defined antero-internal space lævigate, their postero-external angle rounded off. The metasternum is punctured externally rather closely but less strongly, in the middle more strongly and less closely. The puncturation of the ventral segments is well defined but not close, especially in the middle; the ventral series consist of fine hairs and are obscure. The hind femora are not much wider than the intermediate, their inner apical angle feebly defined. The three external teeth of the front tibiæ are sharp and well defined, the uppermost hardly half as large as the middle one, the tibial outline from its base to the apex of the uppermost tooth being straight. The basal piece of the hind claws is sharply but very minutely toothed at its apex, and is a good deal longer than the apical piece. The pygidium in the type is rather roughly punctured and feebly carinate down the hind part of the middle; in other examples this sculpture seems much enfeebled.

Princetown (Victoria); taken by Mr. T. G. Sloane.

H. SIMIUS, sp.nov.

Minus elongatus; postice leviter dilatatus; sat nitidus; ferrugineus, antennis testaceis; pilis fulvis sat brevibus adpressis sparsim vestitus; capite crebre sat crasse, prothorace postice sat (antice magis etiam) crebre subtiliter, elytris crebre minus subtiliter squamose, pygidio (hoc exempli typici longitudinaliter carinato) fortius sparsim, punctulatis; labro clypeum late leviter superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali multo longiori; coxis posticis metasterno sat brevioribus. [Long. $3\frac{4}{5}$, lat. 2 lines.

The "trilobed" appearance of the head is scarcely defined; the front face of the labrum is more strongly concave than in most species of the genus, owing to which, when the front outline of the head is viewed from the point most favourable for observing a "trilobed" appearance, the outline of the middle lobe appears truncate (or almost concave); besides which the lateral lobes are

so feebly reflexed that the distinction of one lobe from another is almost lost. In most other respects very like *H. vacuus*, but with the following distinctions;—the front angles of the prothorax are less advanced, and the hind angles are from some points of view sharply rectangular or subacute (in *vacuus* they appear quite rounded off from all points of view), the base is strongly bisinuate, the surface is a little more closely punctulate, and the puncturation of the elytra is deeper and more conspicuous.

N. S. Wales; in the collection of Sir William Macleay.

H. RUSTICUS, sp.nov.

Minus elongatus; postice leviter dilatatus; subnitidus; ferrugineo-piceus, antennis palpisque testaceis; pilis aureis vestitus (his exemplo typico plerisque evulsis); capite crasse rugulose, prothorace elytrisque subæqualiter fortius nec crebre, pygidio inæqualiter, punctulatis; clypeo labrum late leviter superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali parum longiori, apice subfortiter producta; coxis posticis metasterno paullo brevioribus.

[Long. $3\frac{4}{5}$, lat. 2 lines (vix).

The description of the head in the detailed description of *H. vacuus* may be taken as applying to this insect also. The prothorax is nearly twice as wide as long, its base not quite half again as wide as its front which is only very feebly concave, with very small angles; the sides are gently arched, the hind angles scarcely distinct from any point of view, the base rather distinctly bilobed. The puncturation of the elytra scarcely differs from that of the prothorax except in being a little closer; there is scarcely a trace even of a sutural stria or of any transverse wrinkling; the lateral fringe is normal, the apical membrane distinct. The description of the underside in *H. vacuus* may be applied to this species except that the metasternum is exceptionally short, (being not much longer than the hind coxæ, and suggesting a doubt whether this species might not find its place better among species having the hind coxæ elongated), and that the ventral

series are well defined, consisting of stout fulvous hairs. The hind femora are a good deal wider than the intermediate, their inner apical angle being scarcely distinct. The three external teeth of the front tibiæ are strong but rather blunt, the uppermost small, the tibial outline from its base to the apex of the uppermost tooth is straight. The apical piece of the hind claws is not very much shorter than the basal which is distinctly produced at the apex, but its produced apex is much smaller than half the apical piece.

Apart from colour this species bears much resemblance to *H. sparsus* (from the same locality) but it is a more robust, larger insect, with the puncturation (especially on the prothorax) larger, shallower, and less sparing, and the produced apex of the basal piece of the hind claws much smaller.

N. Territory of S. Australia; taken by Dr. Bovill.

H. NIGRINUS, sp.nov.

Minus elongatus; postice vix dilatatus; sat nitidus; niger, antennis palpisque testaceis, pedibus plus minus piceis; pilis albidis brevibus minus dense vestitus; clypeo crasse rugulose, capite postice crasse minus crebre, prothorace paullo minus crasse sub-crebre, elytris crassius squamose, pygidio obsolete (hoc longinaliter carinato nonnullis exemplis rufescenti) punctulatis; labro clypeum late minus fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali sat longiori; coxis posticis metasterno sat brevioribus.

[Long. 3 (vix), lat. $1\frac{2}{5}$ lines.

The structure and sculpture of the head do not differ in any noticeable manner from those of the preceding two species. The detailed description of the prothorax of *H. vacuus* will apply to this species, but the puncturation is very evidently coarser. The elytra are punctured slightly more coarsely and closely than the prothorax, with a somewhat squamose appearance and a good deal of transverse wrinkling,—especially towards the sides; they have no defined striation; their lateral fringe is normal and their apical membrane narrow but distinct. The hind coxæ and metasternum

do not differ perceptibly from those of *H. vacuus*, except in the former (together with the ventral segments) being very finely coriaceous and therefore less nitid. The ventral segments bear at the sides well defined but not close puncturation, their middle part being almost without defined punctures but more strongly coriaceous. The description of the legs of *H. vacuus* may be applied to this insect.

Apart from colour differences *H. nigrinus* resembles *H. vacuus*, but is on the upper surface very much more coarsely punctulate, and on the underside coriaceous and much less nitid.

A larger specimen (long. $3\frac{3}{5}$ lines) does not seem to differ except in respect of size.

Neighbourhood of Adelaide.

H. OSCILLATOR, sp.nov.

Minus elongatus; postice vix dilatatus; minus nitidus; obscure ferrugineus, antennis palpisque testaceis; pilis fulvis elongatis adpressis (hic illic in capite nonnullis erectis) vestitus; capite crasse rugulose nec crebre, prothorace fortiter sat crebre, elytris subtilius squamose crebre, pygidio (hoc subtiliter coriaceo) sparsim obsolete, punctulatis; labro clypeum late minus fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali multo longiori; coxis posticis metasterno sat brevioribus. [Long. 3, lat. $1\frac{1}{2}$ lines.

This species is extremely close to *H. nigrinus* and the whole of the detailed description (above) of that species may be applied to it, so far as is consistent with the Latin diagnosis. The following are the principal differences between the two: in *oscillator* the clypeal suture is less distinct, the prothorax is more strongly and closely punctured, the elytra are very much more closely, finely, and squamosely punctured (their puncturation resembling that in *H. punctipennis* and *Mulwalensis*, without being quite so fine and close as in those species) and the basal piece of the hind claws is larger in proportion to the apical piece with its apex less decidedly

produced into a sharp tooth. The example before me, moreover, is less nitid than *H. nigrinus* and of a different colour.

N. Territory of S. Australia; taken by Dr. Bovill.

H. RAPAX, sp.nov.

Minus elongatus; postice dilatatus; subnitidus; ferrugineus, antennis palpisque testaceis; pilis sparsis fulvis adpressis parum perspicue vestitus; clypeo crebre rugulose, capite postice prothorace elytris (his transversim rugatis, longitudinaliter vix perspicue costatis) et pygidio multo minus crebre, fortius punctulatis; labro clypeum sat fortiter sat anguste superanti; antennis 9-articulatis; unguiculis elongatis appendiculatis, unguiculorum posticorum parte basali apicali multo longiori; coxis posticis metasterno sat brevioribus. [Long. $4\frac{4}{5}$, lat. $2\frac{1}{2}$ lines.

The trilobed appearance of the outline of the head is fairly well defined, the middle lobe being about as long, and rather more than half as wide, as the lateral ones,—none of them however being very prominent. The clypeus is roundly and moderately concave across the front and finely margined all across,—its surface coarsely and closely but not deeply rugulose, punctulate,—its suture feebly angulated in the middle, and carinated except in the middle part (if this be a constant character it is highly distinctive), its plane scarcely distinct from that of the rest of the head which is punctured (like the prothorax) smoothly, rather closely and not deeply. The prothorax is very nearly twice as wide as long, its base not quite half again as wide as its front which is somewhat deeply concave with angles well produced but not very sharp; the sides are gently arched, the base strongly bisinuate but not much lobed hindward in the middle, the hind angles rounded. The elytra are punctured a little more closely and coarsely than the prothorax and somewhat squamosely, their transverse wrinkling is rather conspicuous, their sculpture becomes evidently finer and feebler towards the apex, their lateral fringe is normal, their apical membrane scarcely indicated. The hind coxæ are considerably shorter than the metasternum and much longer than the 2nd

ventral segment, their postero-external corner sharply rectangular, they and the metasternum being punctured rather closely and not very strongly on the sides,—much more sparingly and strongly towards the middle, the former with a distinct smooth antero-internal space. The ventral segments are punctured a little more finely than, and about as closely as, the sides of the metasternum but their sculpture is a little feebler and less close in the middle; the ventral series consist of fine hairs but are fairly conspicuous. The hind femora are not much wider than the intermediate, their inner apical angle feebly defined. The three external teeth of the anterior tibiæ are wide and sharp but not very long, the uppermost being less than half as large as the intermediate, the tibial outline from its base to the apex of the uppermost tooth being straight. The hind claws are exceptionally long, the basal piece being quite twice as long as the apical and having its apex produced in a distinct process, which however is less than half as large as the apical piece. The basal joint of the hind tarsi is not much more than half as long as the 2nd joint.

Victoria (?); taken by Mr. T. G. Sloane.

H. LUBRICUS, sp.nov.

Sat elongatus; postice vix dilatatus; nitidus; ferrugineus, antennis testaceis; pilis fulvis (exemplo typico forsitan abraso sparsissime) vestitus; clypeo crasse subcrebre, capite postice prothorace pygidioque subtilius sparsim, elytris (his transversim perspicue rugatis) fortius sat crebre, punctulatis; labro clypeum sat fortiter late superanti; antennis 9-articulatis; unguiculis elongatis appendiculatis, unguiculorum posticorum parte basali apicali parum longiori; coxis posticis metasterno sat brevioribus.

[Long. $3\frac{1}{5}$, lat. $1\frac{2}{5}$ lines.

The trilobed appearance of the outline of the head is very feebly defined owing to the slight convexity of the upper edge of the labrum which makes the latter appear (unless viewed from very far back) as a wide truncate projection from the front; viewed from very far back (*i.e.* very obliquely, almost along the surface of

the head) the middle lobe appears slightly longer, and scarcely narrower than the lateral lobes. The clypeus is scarcely emarginate and scarcely margined across the front, its plane scarcely distinct from that of the rest of the head, its suture very fine and inconspicuous, its sides diverging from the front quite to the eyes. The prothorax is about three quarters again as wide as long, its base not much more than a quarter again as wide as its front which is very slightly emarginate, and slightly advanced in the middle, with very feeble angles; the sides are rather strongly rounded, the base not bisinuate but rather strongly convex hindward all across, the hind angles quite rounded off so that the exact limits of the base are not indicated. The elytra have a fairly defined sutural stria and obscure traces of several other striæ (probably quite obsolete in some examples); their transverse wrinkling is fairly conspicuous, their lateral fringe normal, their apical membrane obsolete. The hind coxæ are a little shorter than the metasternum, but distinctly nearer its length than that of the 2nd ventral segment; they and the metasternum are punctured somewhat coarsely but neither closely nor deeply on the sides, the former being quite and the latter nearly lævigate towards the middle line of the body. The ventral segments are very sparsely punctured,—finely in the middle, less so at the sides; the ventral series consist of moderately stout hairs. The hind femora are moderately wider than the intermediate, their inner apical angle rounded and feeble. The lower two teeth of the anterior tibiæ are strong and sharp, the uppermost very small (very much less than half as large as the intermediate), the tibial outline from its base to the apex of the uppermost tooth being straight. The hind claws are long, the basal piece very little longer than the apical, and sharp but scarcely produced at its inner apex.

Port Lincoln.

H. MONTANUS, sp.nov.

Minus elongatus; postice leviter dilatatus; sat nitidus; ferrugineus, antennis testaceis; pilis fulvis sat brevibus adpressis sparsim vestitus; clypeo crebre crasse rugulose, capite postice

fortiter sat sparsim, prothorace minus fortiter subcrebre, elytris fortius subcrebre, pygidio minus fortiter minus crebre, punctulatis; labro clypeum late sat fortiter superanti; antennis 9-articulatis; unguiculis sat elongatis appendiculatis, unguiculorum posticorum parte basali apicali parum longiori, fortiter compressa; coxis posticis metasterno sat brevioribus; prothorace canaliculato.

[Long. 4, lat. 2 lines.

The "trilobed" appearance of the head is fairly well defined, the middle lobe as long, and nearly as wide, as the lateral lobes. The clypeus is only feebly emarginate and is finely margined all across, its plane not continuous with that of the rest of the head, its suture well marked and widely angulated. The prothorax is $\frac{3}{5}$ again as wide as long, its base $\frac{3}{5}$ again as wide as its front which is somewhat deeply concave with well produced sharp angles; the sides are nearly straight; the base is distinctly bisinuate with the middle scarcely lobed hindward; the hind angles are from some points of view almost sharply rectangular. The elytra have no trace of striæ, their transverse wrinkling is little noticeable, their lateral fringe normal, their apical membrane distinct. The hind coxæ are about intermediate in length between the metasternum and 2nd ventral segment; they, the metasternum, and the ventral segments are punctured somewhat strongly and closely at the sides and more sparsely towards the middle, the hind coxæ having a well-defined lævigate antero-internal space. The ventral series consist of fine hairs and are very inconspicuous. The hind femora are not very much wider than the intermediate, their inner apical angle being scarcely defined. The external teeth of the front tibiæ are as in *H. lubricus* except that the uppermost is not quite so small in proportion to the others. The strongly compressed basal piece of the hind claws is a conspicuous character.

Blue Mountains, N.S.W.; sent by Mr. T. G. Sloane.

H. CONCOLOR, Macl.

I have before me two examples of an insect sent to me under this name by Mr. T. G. Sloane, who states that they were taken

in Queensland. They appear to tally very well with the brief description given by Sir W. Macleay (Trans. Ent. Soc. N.S.W., II. p. 196) except in being somewhat larger (long. $3\frac{1}{5}$, lat. $1\frac{3}{5}$ lines). Unfortunately they have both lost their hind claws, but from an inspection of the other claws I have little doubt that the hind ones are appendiculate with the basal piece strongly compressed and not much longer than the apical piece.

The species is extremely close to *H. montanus* but differs from it as follows :—it is smaller, its colour is paler, the puncturation is evidently finer and closer throughout, the trilobed appearance of the front outline of the head is very feeble owing to the slight reflexion of the sides of the clypeus, the prothorax is decidedly more transverse (nearly twice as wide as long) with its base scarcely half again as wide as its front (the former being widely and very distinctly convex hindward, or lobed, in the middle).

H. Rothei, sp.nov.

Minus elongatus; postice leviter dilatatus; sat nitidus; ferrugineus, antennis testaceis; pilis erectis minus brevibus sparsim vestitus; capite antice crebre rugulose postice paullo sparsius vix rugulose, prothorace antice subtiliter crebre postice crassius minus crebre, elytris sparsius fortiter sat squamose, pygidio fortius subcrebre, punctulatis; labro clypeum fortiter minus late superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali sat longiori, sat fortiter compressa; coxis posticis metasterno sat brevioribus.

[Long. $3\frac{3}{5}$, lat. $1\frac{4}{5}$ lines.

The "trilobed" appearance of the front of the head is exceptionally well defined, the middle lobe appearing as long and a little more than half as wide as the lateral lobes. The clypeus is gently concave across the front, with a fine continuous margin, its plane not continuous with that of the rest of the head, its suture very feebly and widely angulated, its sides converging hindward abruptly and strongly close in front of the eyes, so that their outline is there angulated. The prothorax is $\frac{3}{4}$ again as wide as

long, its base a little less than half again as wide as its front which is widely and not very strongly concave, with sharp moderately prominent angles; the sides are gently arched; the base is gently bisinuate and strongly lobed hindward; the hind angles are exceptionally well defined. The elytra have little or no trace of striation; their transverse wrinkling is ill defined, their lateral fringe normal, their apical membrane obsolete. The description of the underside and legs of *H. montanus*, Blackb., may be read as applying to this species, with the following exceptions:—the lævigate space on the hind coxæ is unusually large, the punctuation of the ventral segments is feeble at the sides and obsolete in the middle, the inner apical angle of the hind femora though much rounded is distinctly prominent, the apical piece of the hind claws is smaller and the uppermost tooth on the anterior tibiæ is very much larger in proportion to the others, being much more than half as large as the intermediate one; a very distinct species; the puncturation of the front of the prothorax much finer and closer than on any other part of the surface together with the exceptionally large uppermost tooth on the front tibiæ will characterize it strongly among its allies. The elytral sculpture is of a decidedly coarse type resembling more or less that of *H. nigellus*, *auricomus*, *piger*, &c., &c.

Sedan, S.A.; taken by Mr. Röthe.

H. PUNCTICOLLIS, sp.nov.

Minus elongatus; postice sat dilatatus; sat nitidus; ferrugineus, antennis testaceis; pilis minutis adpressis obscure sparsim vestitus; capite crebre rugulose, prothorace crebre subtiliter, elytris multo fortius sparsius, pygidio subtilius valde sparsim, punctulatis; labro clypeum fortius nec late superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali sat longiori apice breviter producta; coxis posticis metasterno sat brevioribus. [Long. $3\frac{4}{5}$, lat. $2\frac{1}{5}$ lines.

The "trilobed" appearance of the head is almost as in the preceding species, but the lobes do not appear quite so prominent.

The clypeus is nearly on a continuous plane with the rest of the head from which it is separated by a well marked angulated suture, its outline angulated just in front of the eyes. The prothorax is not quite $\frac{3}{4}$ again as wide as long and slightly more than half again as wide as its front which is widely and gently concave, very slightly bisinuate, and has sharp but little prominent front angles; its sides are somewhat strongly rounded immediately behind the middle, its hind angles exceptionally well defined and almost rectangular; its base is scarcely bisinuate, but somewhat strongly convex hindward in outline; in both the examples before me there is a small distinct round impression of a dark colour on either side near the lateral margin a little behind the middle. The elytra are almost or quite without trace of striation; their transverse wrinkling is feeble, their lateral fringe normal, their apical membrane scarcely visible. The hind coxæ are not much longer than the second ventral segment; they and the metasternum are punctured rather closely but not very strongly,—the puncturation being somewhat even over the whole surface. The puncturation of the ventral segments is feeble and lightly impressed (especially in the middle) but not fine; the ventral series consist of long hairs and are fairly conspicuous. The hind femora are moderately wider than the intermediate, their whole undersurface (*i.e.*, the surface not in contact with the body) being very evenly though not closely punctulate, and their inner apical angle moderately defined though very blunt. The front tibiæ are toothed like those of *H. lubricus*, but with the uppermost tooth even more minute still in proportion to the others.

This is another very distinct species, exceptionally broad behind,—with the relative puncturation of the prothorax and elytra, and the even puncturation of the undersurface (including the hind femora) most unusual among its congeners.

Victoria; taken by Mr. T. G. Sloane.

H. PUSTULOSUS, sp.nov.

Minus elongatus; postice leviter dilatatus; minus nitidus; pilis brevibus adpressis vestitus; setis longis erectis (in tuberculis

parvis positis) in prothorace elytrisque sparsim instructus; obscure ferrugineus, palpis antennisque testaceis; confertim subtiliter (clypeo sat rugulose pygidio a basi gradatim minus crebre) punctulatus; labro clypeum sat fortiter sat late superanti; antennis 9-articulatis; unguiculis appendiculatis: unguiculorum posticorum parte basali apicali haud longiori; coxis posticis metasterno haud brevioribus. [Long. 6-7$\frac{4}{5}$, lat. 3$\frac{2}{5}$-4 lines.

Var. Corpore toto (antennis palpisque testaceis exceptis) piceo vel piceo-nigro.

The "trilobed outline" of the front of the head is well defined, the middle lobe slightly longer than, and decidedly more than half as wide as, the lateral lobes. The clypeus is rather strongly reflexed at the sides, not margined across the front, moderately concave in front, its sides slightly convergent hindward immediately in front of the eyes but not at all angulated, its sculpture a little more coarse and rugulose than that of the rest of the head which does not form a continuous surface with it, and is separated from it by a somewhat wavy suture. The prothorax is not quite $\frac{3}{4}$ again as wide as long, its base rather more than half again as wide as its front which is moderately concave, with front angles sharp but not very much produced; its sides are gently arched, and most divergent close to the base; the hind angles are (from some points of view) not quite non-existent but they are much rounded; its base is decidedly bisinuate, and narrowly but not strongly lobed hindward in the middle. The elytra are very obsoletely costate, the lateral fringe normal, their apical membrane distinct, their transverse wrinkling fine and minute but distinct, their puncturation a little finer and closer than in *H. normalis*. The hind coxæ are very fully as long as the metasternum; both are lightly, closely and rather evenly squamose-punctulate, the former with a very small antero-internal lævigate space, the latter with numerous scattered granules. The ventral segments are punctured like the hind coxæ but less closely,—the middle part more finely than the sides. The ventral series are very conspicuous and consist of stout bristles. The hind femora are very much wider than the intermediate, their inner apical angle obtuse but fairly defined.

The lower two teeth on the front tibiæ are strong but not sharp, the uppermost much less than half as large as the 2nd, the tibial outline straight from its base to the apex of the uppermost tooth. The hind claws are strongly compressed, their basal piece not longer than the apical and having its inner apex sharply produced in a tooth. The erect setæ on the upper surface are placed (each on a small tubercle) along the front margin of the prothorax, a very small number on the sides of the disc of the same, and in rows down some of the obsolete costæ of the elytra,—especially the 1st, 3rd, and 10th.

Very like *H. normalis*, Blackb., but at once distinguished by 9-jointed antennæ, tuberculated surface, slightly feebler punctuation, &c., &c.

Apparently common in S. Australia. Mr. McDougall of Moonta states that he has seen it "swarming round tea-tree." I have seen examples from Port Lincoln, Yorke's Peninsula, Adelaide, Bordertown, Kangaroo Island.

H. ELONGATUS, Blanch.

This insect is so close to the preceding that it will be sufficient to state in what respects the above description must be modified to make it apply to the present species. The form is more elongate, and less dilated behind (long. $6\frac{2}{5}$, lat. $3\frac{1}{10}$ lines); there are no rows of setiferous tubercles running down the elytra; the clypeus is overtopped considerably less widely by the labrum so that the middle lobe of the "trilobed outline" appears to be not more than half as wide as the lateral lobes; the clypeus and rest of the head more nearly form a continuous even surface, and the sutural margin of each elytron ends in a dense cluster of strong spine-like bristles. A few long setæ are to be found on the elytra close to the base.

[It should be noted that I have examined only a single specimen (♀) of this species, which was taken by Sir William Macleay in N. S. Wales, and sent to me by him as *H. elongatus*, Blanch. It agrees very well with Blanchard's description. It is *possible* that the

clusters of bristles at the apex of the elytra may not be found in the male,—but I think unlikely. There is no trace of anything of the kind in either sex of the allied species].

H. agrestis, Burm.

So excessively close to *H. elongatus*, Blanch., that I am unable to specify any tangible distinction except the absence in this species of the cluster of bristles at the apex of each elytron; the relation of the labrum and clypeus,—the portion of the former overtopping the latter being here quite as wide as, and even more prominent than, in *H. pustulosus*; and the general form,—*H. agrestis* being (not less elongate but) more dilated behind the middle of the elytra.

W. Australia. I possess an example from Port Darwin which I hesitate to distinguish from *H. agrestis*, though it is decidedly less dilated behind than any Western Australian specimen that I have seen. It differs from *H. scalptus* in the much wider middle lobe of the "trilobed outline" of the head.

H. rhinastus, sp.nov.

Sat elongatus; postice vix dilatatus; minus nitidus; piceo-niger, antennis palpisque testaceis, pedibus obscure rufo-piceis; pilis brevibus adpressis albidis minus crebre vestitus; pilis longis erectis (præter series marginales) trans prothoracis elytrorumque marginem anticam instructus; confertim sat subtiliter (clypeo subrugulose) punctulatus; labro clypeum anguste fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali haud longiori; coxis posticis metasterno vix brevioribus. [Long. $5\frac{1}{5}$, lat. $2\frac{3}{5}$ lines.

Extremely like the darkly coloured examples of *H. pustulosus* in general appearance, but seems to be invariably smaller. From that species and all the preceding species that follow it, *H. rhinastus* differs in the relation and structure of the labrum and clypeus, owing to which the "trilobed outline" of the head is exceptionally well defined,—the middle lobe appearing very

decidedly longer than, and not at all more than half as wide as, the lateral lobes. The longitudinal series of setiferous granules on the elytra, so marked a character in *H. pustulosus*, are quite wanting here, and the general form is less robust, scarcely dilated behind, legs more slender, external teeth of the front tibiæ a little sharper, prothorax narrower in front, puncturation less fine and close.

A dark red specimen in my collection (locality uncertain) seems to be this species, but it is too much broken for certain identification. I suspect most of the species of this group vary in colour.

S. Australia; Adelaide district, Kangaroo Island, &c.

N.B.—Among a large number of specimens of this insect examined by me I have found one example belonging to Sir William Macleay which has some feeble indications of pustules down the elytra close to the suture. I have not seen any example of *H. pustulosus* in which the pustules are not quite well defined there and in other rows on the elytra. The two species are very distinct by several other characters, and I think the example of *rhinastus* bearing the pustules must be regarded as quite abnormal.

H. SCALPTUS, sp.nov.

Sat elongatus; postice vix dilatatus; minus nitidus; testaceus, capite prothoraceque rufescentibus; pilis brevibus adpressis albidis minus crebre vestitus; pilis longis erectis (præter series marginales) trans prothoracis elytrorumque marginem anticam instructus; confertim subtiliter (clypeo subrugulose) punctulatus; elytris (certo adspectu) subtiliter confertim rugatis vix punctulatis; labro clypeum anguste fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali haud longiori; coxis posticis metasterno vix brevioribus. [Long. $5\frac{1}{5}$, lat. $2\frac{3}{5}$ lines.

Nearest to *H. rhinastus*, I think, but differing widely by the much closer puncturation of the elytra which do not appear

distinctly "punctured" so much as "closely wrinkled transversely;" the prothorax is a little more strongly transverse than in *rhinastus*, the tarsi are shorter and more slender, and the colour of the unique example before me is entirely different; in other respects I do not observe any noteworthy distinction between the two. The narrowly and very strongly elevated labrum together with the absence of rows of setiferous granules and of an apical pencil of setæ from the elytra will distinguish it from *H. pustulosus* and *elongatus*, while the exceptionally well defined "trilobed" appearance of the outline of the head, with the middle lobe prominent, and not more than half as wide as the lateral lobes, will prevent the confusion with it of any other of its allies. The basal joint of the hind tarsi is decidedly shorter than the 2nd.

Mulwala, N.S.W.; taken by Mr. T. G. Sloane.

H. LAMINATUS, sp.nov.

Minus elongatus; postice leviter dilatatus; minus nitidus; brunneo-testaceus, tibiis tarsisque sub-infuscatis; supra crebre subtilius sat æqualiter (pygidio minus crebre excepto) punctulatus; pilis brevibus adpressis crebrius vestitus; labro clypeum latissime sat fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apical- paullo longiori, apice vix dentata; coxis posticis metasterno haud brevioribus. [Long. $3\frac{3}{5}$, lat. 2 lines (vix).

Almost, if not quite, unique in the genus by the great development of the labrum which causes the middle lobe of the "trii lobed outline" of the head to appear decidedly wider, and much longer than the lateral lobes. Its place is evidently near *H. pustulosus*, from which (apart from size, the relation of labrum and clypeus to each other, and the absence of setiferous pustules), it differs as follows: the clypeus is less emarginate in front, and more nearly on an even plane with the rest of the head; the clypeal suture is distinctly carinate; the prothorax is more than $\frac{3}{4}$ again as wide as long and is more rounded laterally with anterior angles less produced and base scarcely at all lobed hindward

in the middle; the elytra show no traces of costæ; the hind coxæ are scarcely so long; the metasternum is not granulate; the lævigate space on the hind coxæ is much larger, the puncturation of the under surface is less close throughout; the lower two teeth on the front tibiæ are extremely sharp; the basal joint of the hind tarsi is but little shorter than the 2nd, and the hind claws are feeble with the apical piece shorter and the basal piece scarcely produced in a tooth at its apex.

Sedan, S.A.; taken by Mr. B. S. Röthe.

H. SUBFERRUGINEUS, Burm.

I feel some hesitation in this identification on account of the following discrepancies:—Dr. Burmeister says that *subferrugineus* is "*aureopubescens*," and speaks of the lateral fringe of the prothorax as much shorter than that of the elytra, neither of which characters do I notice in the specimens before me. The pubescence is very silky as it should be, but is whitish and pruinose rather than golden, and the lateral fringe is very uniform. In all other respects, however, (including several notable characters) the agreement is so satisfactory that I think it better to use the name. The colour of the insect decidedly *has* an orange or golden tone quite unusual in the genus, but it belongs to the derm, not the pubescence. The following description will furnish some particulars not mentioned by Dr. Burmeister.

Very strongly convex (more so than is usual in the genus), also unusually elongate and at its widest very little behind the middle of the elytra; the colour a pale orange or golden brown, the head, prothorax and legs more reddish in some examples. The surface is thinly clothed with short adpressed whitish-grey hairs, and in some lights has a distinctly pruinose appearance. The "trilobed outline" of the head is fairly defined,—the middle lobe being, however, very evidently longer, and scarcely narrower, than the lateral lobes. The front of the clypeus very feebly concave; its surface forms an almost perfectly even plane with that of the rest of the head from which it is separated by an obscure suture

scarcely angulated in the middle. The prothorax is all but twice as wide as long, the widest part (the base is quite undefined, owing to the hind angles being completely rounded off) is not quite half again as wide as the front which is feebly concave with angles neither much produced nor particularly acute; the sides are strongly rounded, widest immediately behind the middle; the base is feebly trisinuate, the middle hardly perceptibly lobed hindward. The elytra bear some faint suggestions of striæ; their transverse wrinkling is not noticeable, their lateral fringe is normal, their apical membrane obscure. The whole upper surface appears to be of a velvety texture which with the pubescence entirely conceals the sculpture,—but in an abraded example it is seen that the puncturation of the prothorax, elytra and pygidium is faint, fine and close, and that of the head stronger but scarcely closer (the clypeus, however, being closely, but by no means coarsely, rugulose). The underside is very like that of *H. pustulosus*, but the following differences should be noted: the entire surface has a slight silky lustre (most conspicuous on the hind coxæ),—the metasternum is not granulated,—the puncturation of all parts is a little finer and less close,—the ventral series consist of long, stout, yellow hairs, and seem more conspicuous in an example of equal freshness. The hind femora are not so much wider than the intermediate as in *H. pustulosus*, the apical piece of the hind claws is shorter in proportion to the basal, and the uppermost tooth of the front tibiæ is considerably smaller in proportion to the lower teeth. The tarsi also are longer and more slender, the 2nd joint of the hind tarsi scarcely as long as the basal joint. The antennæ are 9-jointed. [Long. $3\frac{2}{5}$-5, lat. $1\frac{3}{5}$-$2\frac{2}{5}$ lines.

W. Australia.

H. DOCTUS, sp.nov.

Sat elongatus; postice leviter dilatatus; minus nitidus; rufo ferrugineus fere aurantiacus; pilis minus brevibus adpressis albidis subtilius vestitus; corpore vix perspicue (nisi sub lente forti) punctulato; labro clypeum sat fortiter sat late superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum

parte basali apicali vix longiori; coxis posticis metasterno haud brevioribus. [Long. 4-4$\frac{3}{5}$, lat. 2 (vix)-2$\frac{1}{5}$ lines.

This species is so closely allied to the preceding that it will be sufficient to mention the differences. The middle lobe of the "trilobed outline" does not appear much more than half as wide as the lateral lobes, and is strongly convex in outline. The prothorax is evidently less than twice as wide as long (by measurement about $\frac{4}{5}$ again as wide as long), the basal piece of the hind claws is shorter in proportion to the apical piece, and the 2nd joint of the hind tarsi is very distinctly longer than the basal joint.

S. Australia; apparently rare,—I have seen only two examples.

H. PEREGRINUS, sp.nov.

Sat elongatus; postice leviter dilatatus; minus nitidus; ferrugineus, antennis palpisque testaceis; pilis minus brevibus adpressis sat dense vestitus; subtiliter crebre (clypeo subtiliter ruguloso) punctulatus; labro clypeum (hoc antice fere truncato) late sat fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali sat longiori; coxis posticis metasterno haud brevioribus.

[Long. 3$\frac{2}{5}$, lat. 1$\frac{3}{5}$ lines.

Owing to the very slight concavity of the front of the clypeus and the width of the erect part of the labrum, the front outline of the head does not appear distinctly trilobed from any point of view, but from the most favourable point it appears as a feebly bisinuate curve the middle part of which is suddenly much more convex than the lateral portions, this middle part (which represents the middle lobe of the "trilobed outline") being not much narrower than the lateral portions. The plane of the clypeus is evenly continuous with that of the rest of the head, the clypeal suture being faint and nearly straight. The prothorax is almost $\frac{3}{4}$ again as wide as long, its base being only about a quarter again

as wide as its front, which is feebly concave with angles sharp but feebly produced; its sides are gently arched and most divergent scarcely behind the middle, its hind angles quite rounded off (from all points of view); its base is gently bisinuate and very feebly and widely lobed hindward in the middle. The elytra have feeble indications of several striæ (especially a sutural one), their transverse wrinkling is not apparent; their lateral fringe is normal, their apical membrane distinct. The underside and legs scarcely differ from the same in *H. pustulosus* except as follows:—the metasternum is not granulate, the teeth on the front tibiæ are sharper, and the basal piece of the hind claws is longer in proportion to the apical piece.

This species differs little in puncturation from *H. pustulosus*, *elongatus*, and *agrestis*, but it has a little of the velvety texture and pruinose aspect of the insect I take to be *H. subferrugineus*. Apart from size it differs from them all in the structure of the head; from *H. proxima*, Burm., (another nearly allied species) it differs *inter alia* by its much smaller size, and distinct apical membrane of the elytra; it also resembles *H. bidentatus*, Blackb., differing *inter alia* in the structure of the claws and the very evidently finer and closer puncturation of the elytra.

W. Australia; sent by E. Meyrick, Esq.

H. VAGANS, sp.nov.

Minus elongatus; postice leviter dilatatus; subnitidus; ferrugineus, antennis palpisque dilutioribus; pilis brevibus adpressis et longis erectis minus dense vestitus; capite (clypeo magis crebre excepto) prothoraceque sat crasse minus crebre, elytris squamose sat crasse sat crebre, pygidio (hoc opaco coriaceo) obscure, punctulatis; labro clypeum fortiter peranguste superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali sat longiori; coxis posticis metasterno vix brevioribus. [Long. $4\frac{3}{5}$, lat. $2\frac{2}{5}$ lines.

The "trilobed outline" of the front of the head is exceptionally well defined, the middle lobe appearing to be slightly longer than, and about a quarter of the width of, the lateral lobes. The clypeus is well reflexed at the sides, arcuately and somewhat strongly emarginate in front, and margined all across, its sides convergent hindward at their extreme base, its sculpture a little closer but not coarser than that of the rest of the head with which it does not form a continuous surface, the suture being well marked, angulated in the middle and sinuous on either side. The prothorax is nearly $\frac{3}{4}$ again as wide as long, its base about half again as wide as its front margin which is strongly emarginate, with sharp well produced angles (from some points of view it has a bisinuate appearance); its sides are slightly arched being almost at their widest at the base; its hind angles are seen to be much rounded off when the true margin is examined, but from some points of view they appear sharp and slightly produced hindward; the punctures of the surface are rather coarse and spaced so that about 16 of average distance would lie longitudinally down the middle line; the base is distinctly bisinuate, the middle lobe moderate. The transverse wrinkling of the elytra is moderately conspicuous from some points of view, their lateral fringe normal, their apical membrane narrow but distinct. The hind coxæ are scarcely shorter than the metasternum, both being rather deeply punctured, somewhat finely and closely at the sides but more coarsely and sparingly towards the middle, the former having a well defined lævigate antero-internal space near which its puncturation is very coarse indeed. The puncturation of the ventral segments resembles that of the metasternum but does not become so coarse in the middle. The ventral series consist of stout short bristles. The hind femora are moderately wider than the intermediate, their surface being much punctured and their inner apical angle but little defined. The lower two teeth on the front tibiæ are long and robust but not very sharp, the uppermost well defined but less than half as large as the 2nd. The 2nd joint of the hind tarsi is exceptionally long as compared with the basal one; the hind claws are robust,

the basal piece much longer than the apical and having its inner apex produced in a short sharp tooth.

Widely distributed; I have seen specimens from Queensland, N.S.W., Victoria, and S. Australia, among which I find no variation likely to indicate specific distinction. The colour is in some examples more or less pitchy. *H. pubescens*, Macl., is probably identical, but the name is pre-occupied by Erichson for a Tasmanian species which would fall in my Section I.

H. MIMUS, sp.nov.

Sat elongatus; postice vix dilatatus; subnitidus; ferrugineus, antennis palpisque testaceis; pilis brevibus adpressis sat dense vestitus; capite prothoraceque sat crasse minus crebre, elytris squamose sat crasse sat crebre, pygidio sparsius minus crasse, punctulatis; labro clypeum fortiter peranguste superanti; antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali sat longiori; coxis posticis metasterno vix brevioribus. [Long. $4\frac{1}{5}$, lat. $2\frac{1}{5}$ lines (vix).

Very near *H. vagans*, from which it differs in being a little more elongate, and less dilated behind the middle,—in the considerably more quadrate prothorax which is nearly $\frac{4}{5}$ again as wide as long and is not more than $\frac{1}{3}$ again as wide at the base as in front and has its hind angles more rounded off,—in the absence of erect hairs on the upper surface mixed among the general pubescence,—in the greater uniformity of sculpture on the head,—and in the much more distinct puncturation of the pygidium.

W. Australia; sent to me by E. Meyrick, Esq.

H. FLAVUS, sp.nov.

Sat elongatus; postice leviter dilatatus; minus nitidus; flavo-brunneus, capite prothoraceque sub-rufescentibus; pilis minus brevibus vix depressis sat sparsim vestitus; subtilius minus

sparsim (clypeo crasse rugulose) punctulatus; labro clypeum late sat fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis, fortiter compressis, unguiculorum posticorum parte basali apicali paullo longiori; coxis posticis metasterno paullo brevioribus. [Long. $3\frac{3}{5}$, lat. $1\frac{4}{5}$ lines.

The outline of the front of the head is at most very feebly "trilobed" from any point of view, owing to the width and prominence of the labrum, on account of which the lobes are feebly distinguished one from another, the middle lobe however projecting further forward than, and appearing fully as wide as, the lateral ones. The labrum is well raised above the clypeus, which is exceptionally declivous in its front part, is feebly concave in front, is margined all across, and forms an almost even plane with the rest of the head, from which it is separated by a somewhat sinuous suture. The prothorax is a little more than half again as wide as long, its base scarcely a third again as wide as its front, which is slightly emarginate, with feeble rounded angles; its sides are moderately rounded, being at their greatest divergence in the middle; its hind angles viewed from above appear very little marked and not at all directed hindward, but not quite rounded off; its basal outline is scarcely bisinuate, but rather strongly convex hindward all across; its surface is not closely punctured, but nevertheless (owing to the fineness of the punctures) about 20 at average distance apart would run down the middle line, which shows some faint indication of a longitudinal channel. The elytra are punctured almost as the prothorax; they bear scarcely a trace of striation (except the sutural stria), their transverse wrinkling is fine and feeble, their lateral fringe normal, their apical membrane distinct but very narrow. The hind coxæ are distinctly (but not much) shorter than the metasternum, both being punctured rather coarsely (especially the former) but not very deeply, rather closely at the sides and much more finely towards the middle, the former having an ill-defined lævigate antero-internal space. The puncturation of the ventral segments is fine, squamose, and somewhat even, but

not at all close; the ventral series consist of stout hairs springing from small granules and are very conspicuous. The hind femora are moderately wider than the intermediate, and have their inner apical angle scarcely marked. The lower two teeth of the anterior tibiæ are robust and sharp, the uppermost is all but obsolete, its place being indicated by a mere nick on the tibial outline. The inner apex of the basal piece of the hind claws is feebly produced in a kind of tooth.

This species is undoubtedly allied in many respects to the *H. vacuus* group, from which its hind coxæ (considerably longer on the external margin in proportion to the length of the metasternum) will at once distinguish it. I think it is a somewhat isolated form. Its pale yellowish-brown colour is peculiar and apparently constant.

Mulwala, N.S.W.; taken by Mr. T. G. Sloane.

H. LONGULUS, sp.nov.

Elongatus; postice vix dilatatus; subnitidus; flavo-ferrugineus, pilis brevibus adpressis minus sparsim vestitus; clypeo crasse rugulose, capite prothoraceque subtiliter sat crebre, elytris pygidioque minus subtiliter minus crebre, punctulatis; labro clypeum late sat fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali parum longiori; coxis posticis metasterno vix brevioribus.

[Long. 3-4, lat. $1\frac{2}{5}$-$1\frac{4}{5}$ lines.

Apart from colour and puncturation this species bears so much resemblance to *H. subferrugineus* and *doctus* that the description of the former of these species may be taken to apply to the present one subject to the following remarks:—the colour is ferruginous (a little more yellowish than is common in the genus, but not at all "orange" in tone), and there is no velvety pruinose or iridescent appearance whatever; the elytra are a little more dilated behind the middle; the convexity of the body is not

noticeably greater than is usual in the genus; the middle lobe of the "trilobed outline" of the head is scarcely so much longer than the lateral lobes; the front of the clypeus is evidently declivous; the prothorax is not so transverse being not quite three quarters again as wide as long, the base being gently but almost evenly and continuously convex hindward, the middle however presenting on careful inspection a very slight sinuation or concavity; the elytra are evidently wrinkled transversely; the under surface is nitid and moderately strongly but not closely punctured (much more coarsely and sparsely than in the species of the *pustulosus* type), the hind coxæ having a small but distinct antero-internal lævigate space. The ventral series consist of hairs and are not very conspicuous. The entire puncturation of the upper surface is very manifestly stronger, coarser, and less close; that of the elytra being coarser than, and that of the prothorax very similar to, the same in *H. flavus*. The present species also resembles *H. flavus*, but it is more nitid and of a decidedly ferruginous tone of colour, with the clypeus wide in front as well as with the elytra differently punctured as just noted. The elytra have the suture somewhat elevated, and becoming keel-like near the apex, the apex itself being prominent, almost spiniform.

S.A.; I have seen it only from the Adelaide district.

H. ANGUSTUS, sp.nov.

H. longulo valde affinis; differt prothorace ad latera minus rotundato, lateribus basin versus minus convergentibus, angulis posticis (superne visis) sat minus rotundatis; elytris minus fortiter punctulatis, sutura minus convexa apicem versus haud carinata, apice suturali nullo modo spiniformi. [Long. $4\frac{1}{5}$, lat. 2 lines.

So extremely close to *H. longulus* that it would be useless to repeat the Latin diagnosis in full, but I am convinced that it represents a distinct species. I do not observe any differences beyond those mentioned above except that the two examples before me are a trifle larger than any *H. longulus* I have seen, and of a some-

what paler colour, and that the middle of the base of the prothorax is quite evenly convex hindward. The difference in the form of the suture of the elytra near, and at, the apex renders the two quite easy to distinguish. The ventral series of hairs seem a little more conspicuous than in *H. longulus.* Compared with *H. flavus* the size is very evidently greater and the elytra are evidently longer and less dilated hindward, with puncturation less close and fine; their colour also has a ferruginous reddish tone that is entirely wanting in those of *H. flavus* of which I have seen many examples but no varieties in this respect.

S. Australia; Victor Harbour and Kangaroo Island.

H. POSTICALIS, sp.nov.

Sat elongatus, postice vix dilatatus; subnitidus; ferrugineus, antennis palpisque testaceis; pilis brevibus adpressis minus sparsim vestitus; clypeo crasse rugulose, capite prothorace pygidioque crebrius minus fortiter, elytris crebrius squamose minus fortiter, punctulatis; labro clypeum minus late minus fortiter superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali paullo longiori; coxis posticis metasterno vix brevioribus; elytrorum membrana apicali valde producta. [Long. $3\frac{3}{5}$, lat. $1\frac{4}{5}$ lines.

The "trilobed" appearance of the head is feeble, all the lobes being little developed, the middle lobe as long and little more than half as wide, as the lateral lobes. The clypeus is rather strongly concave in front, and is margined all across; it almost forms an evenly continuous surface with the rest of the head, from which it is separated by a feeble suture. The prothorax is half again as wide as long, its base not quite half again as wide as its front which is rather strongly emarginate, with sharp well-produced angles; its sides are gently arched, and have their greatest divergence a little behind the middle; the hind angles viewed from above do not appear so entirely rounded off as they are seen

to be in reality when inspected from the side; the base is scarcely bisinuate but is rather decidedly lobed hindward; the puncturation is spaced so that scarcely 20 punctures of average distance could be placed in a line down the middle. The elytra are punctured not very differently from the prothorax but squamosely and a trifle more coarsely, whence the puncturation appears a little closer; they bear scarcely a trace of striation except the sutural striæ; the transverse wrinkling is somewhat conspicuous from some points of view and their lateral fringe is normal; the apical membrane is very strongly developed projecting hindward from the apex of the elytra in a wide riband-like band which is widest at the suture where it projects almost as far as the length of one of the hind claws. The hind coxæ are decidedly (but not much) shorter than the metasternum, both being punctured somewhat coarsely, rather closely at the sides and much more sparingly towards the middle, the former having a small well-defined lævigate antero-internal space. The puncturation of the ventral segments is lightly impressed and sparse, but fairly even; the ventral series consist of fine hairs and are very inconspicuous. The hind femora are not much wider than the intermediate, their inner apical angle being feeble. The teeth of the anterior tibiæ are robust and sharp, the uppermost less than half as large as the second. The inner apex of the basal piece of the hind claws is scarcely produced in a tooth.

The exceptional development of the apical membrane of the elytra is quite invariable in the moderately numerous series before me.

S. Australia; in the Adelaide district; on Eucalyptus leaves.

H. COLLARIS, sp.nov.

Sat elongatus; postice vix dilatatus; subnitidus; obscure ferrugineus, antennis palpisque testaceis; pilis adpressis minus brevibus minus sparsim vestitus; capite (clypeo crasse rugulose excepto) sparsius fortius, prothorace crebrius minus fortiter, elytris crebre

subtilius, pygidio leviter sparsim, punctulatis; antennis 9-articulatis; labro clypeum late sat fortiter superanti; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali sat longiori; coxis posticis metasterno haud brevioribus.

[Long. $2\frac{4}{5}$, lat. $1\frac{3}{5}$ lines.

The outline of the head does not from any point of view present a distinctly "trilobed" appearance; as in *H. peregrinus*, from the most favourable point it appears as a continuous curve the convexity of which is much stronger in the middle than at the sides. There are some long erect hairs on the head and the front of the prothorax. The clypeus is almost truncate in front, its surface evenly continuous with that of the rest of the head from which it is separated by a well marked angulated suture. The prothorax is nearly $\frac{3}{4}$ again as wide as long, its base (which is wider than the base of the elytra) less than $\frac{1}{3}$ again as wide as the front, which is somewhat bisinuate with moderately sharp but not strongly produced angles; its sides are gently rounded; its hind angles fairly marked from some points of view though not at all sharp nor directed hindward; its base is rather narrowly, but not strongly, lobed in the middle, the puncturation is spaced so that about 20 punctures of average distance apart could be placed in a line down the middle. The elytra have a fairly distinct sutural stria but scarcely any indication of other striæ; their transverse wrinkling is somewhat conspicuous, their lateral fringe normal, their apical membrane scarcely distinct. The hind coxæ are a trifle longer than the metasternum, both being strongly punctured even in the middle, but not very closely, the former having a scarcely defined lævigate antero-internal space. The puncturation of the ventral segments is sparse and feeble; the ventral series consist of stout hairs and are conspicuous. The hind coxæ are a good deal wider than the intermediate, their inner apical angle being fairly well defined. The teeth of the

anterior tibiæ are robust but not very sharp, the uppermost less than half as large as the intermediate. The inner apex of the basal piece of the hind claws is produced in a well defined sharp tooth which however is much less than half as large as the apical piece.

Adelaide.

H. MARGINATUS, sp.nov.

Sat elongatus; postice leviter dilatatus; sat nitidus; rufus, antennis palpisque testaceis, elytris abdomineque olivaceo-piceis (hoc apice rufo, illis latera versus rufescentibus) prothorace piceo-umbrato; subglaber (fimbriis usitatis exceptis); capite (clypeo crasse rugulose excepto) fortius sparsissime, prothorace fortius sat sparsim, elytris fortiter sat sparsim, pygidio (hoc pilis nonnullis vestito) leviter sat crasse, punctulatis; antennis 9-articulatis; labro clypeum vix superanti; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali parum longiori; coxis posticis metasterno haud brevioribus. [Long. $3\frac{1}{5}$, lat. $1\frac{3}{5}$ lines.

The labrum does not rise above the *general* plane of the clypeus but (owing to the strong anterior declivity of the latter) it overtops the *front* of the same; it is one of a few species that seem to hover a little doubtfully between my " main sections" II. and III., of the genus, but I place it in Section III. because from a certain point of view the "trilobed outline" of the head appears fairly well defined, having the lobes equal *inter se* in length and breadth; in other respects the structure of the head resembles that of *H. collaris.* The prothorax is scarcely more than half again as wide as long, the base being about $\frac{1}{3}$ again as wide as the front which is bisinuate, with blunt scarcely produced angles; the sides are moderately rounded, the hind angles (from all points of view) though obtuse yet quite well defined and scarcely at all rounded off; the base is gently bisinuate and feebly

lobed hindward in the middle; the puncturation is spaced so that about 17 or 18 punctures of average distance apart could be placed in a line down the middle. The elytra resemble those of *H. collaris* (except in their much coarser puncturation, their scarcely appearing transversely wrinkled from any point of view, and the apical membrane being better developed). The puncturation and structure of the legs and underside scarcely seem to differ from that of *collaris* except as follows:—the hind coxæ are scarcely so long, the general puncturation is more enfeebled towards the middle of the body, the inner apical angle of the hind femora is less marked, the uppermost tooth on the front tibia is feebler, and the basal piece of the claws is considerably less produced in a tooth.

In some respects must be near *H. rufomarginatus*, Blanch., but I cannot regard it as that insect because *inter alia* it differs from the description as follows:—it is much smaller (*H. rufomarginatus* should be $4\frac{1}{2}$-5 lines), and not pubescent (I do not think the example before me is abraded), and its prothorax is distinctly narrower (not "wider") than the elytra.

Endeavour River; in the collection of Sir W. Macleay.

H. IRIDIVENTRIS, sp.nov.

Minus elongatus; postice haud dilatatus; minus nitidus; niger, subtus plus minus iridescens; antennis palpisque testaceis; elytris rubidis; pedibus rufo-testaceis; supra (fimbriis solitis exceptis) fere glaber; subtus sparsim pilosus; obsolete sat sparsim (clypeo crebre rugulose excepto) punctulatus; labro clypeum sat leviter sat late superanti; antennis 9-articulatis; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali sat longiori, apice breviter acute dentata; coxis posticis metasterno vix brevioribus. [Long. $3\frac{2}{5}$, lat. $1\frac{4}{5}$ lines.

Var. A. Elytris pedibusque obscurioribus.

Var. B. (? immat.) Subtus cum capite plus minus rufescens.

The "trilobed outline" of the front of the head is fairly well-defined—the middle lobe appearing about as long, and about half as wide, as the lateral lobe. The labrum rises only moderately above the surface of the clypeus, the front of which is feebly emarginate and scarcely margined continuously; the surface of the clypeus is scarcely distinct from that of the rest of the head, even the suture being feeble; the sides of the clypeus are almost parallel immediately in front of the eyes and then become convergent forward; there are a few long erect hairs on the head. The prothorax is nearly half again as wide as long, its base nearly half again as wide as its front, which is moderately emarginate, with sharp somewhat produced angles; its sides are strongly rounded, their greatest divergence being behind the middle; its hind angles are completely rounded off; its basal outline is scarcely bisinuate but is rather strongly convex hindward all across; its puncturation is not unlike that of the same part in *H. flavus*, but seems a little less close and more lightly impressed. The elytra have scarcely a trace of even a sutural stria; their puncturation differs little from that of the prothorax, but is coarser and less close; they are almost devoid of transverse wrinkling; the lateral fringe is normal, the apical membrane obsolete. The hind coxæ are scarcely, if at all, shorter than the metasternum. The whole undersurface is punctured somewhat evenly, faintly and sparingly, the punctures on the metathorax being somewhat squamose-granulate. The ventral series are well-defined, consisting of stout pale hairs. The hind femora are much wider than the intermediate, their inner apical angle being very feeble. The lower two teeth of the anterior tibiæ are robust and very sharp; the uppermost, though sharp and well-defined, is

quite small (much less than half as large as the intermediate). The hind claws are long and slender, their basal piece considerably longer than the apical, and having a well-defined tooth at its inner apex—which, however, is very much less than half the size of the apical piece of the claw.

An extremely distinct species, conspicuous for its velvety appearance—strongly pruinose in some lights—the iridescence of its undersurface, and its faint rather large puncturation, a *tout ensemble* reminding one of *Liparetrus discipennis*, Guér., and its allies. The deep crimson-copper colour of the elytra in ordinary specimens is also remarkable, some indication of that tinge persisting in even the darkest specimens I have seen.

Port Lincoln, also Yorke's Peninsula; a specimen belonging to Sir W. Macleay is said to be from King George's Sound.

NOTES ON AUSTRALIAN COLEOPTERA, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem. Linn. Soc. N.S.W.

Part IV.

The following notes and descriptions of new genera and species are directly or indirectly the outcome of examining a small collection of *Carabidæ* together with a few *Longicornes* sent to me by Mr. W. D. Randall from Barrow's Creek in Southern tropical Australia, and—from collections recently received from Central Australia (Mr. Wild) and the Northern Territory (Dr. and Mrs. Bovill)—such species as are connected with those Mr. Randall sent. I deeply regret to mention that Dr. and Mrs. Bovill have now left Australia and so put an end to their valuable and highly intelligent explorations.

LEBIIDES.

Phlœocarabus.

I have several species in my collection which appear to belong to this genus. The characters given by Sir William Macleay in the "Insects of Gayndah" (Trans. Ent. Soc. N.S.W. II. p. 85) distinguish it satisfactorily from all other Australian genera of *Lebiidæ* yet described, and the species before me present all the characters specified very satisfactorily. In all of them the head is rather strongly dilated laterally behind the eyes (as in *Xanthophœa)* which causes the part of the head immediately in front of the neck to be wider than in some allied forms. No doubt this is what Sir W. Macleay refers to when he says "head suddenly narrowed behind the eyes into a distinct neck." The claws are simple.

[While this memoir has been in the printer's hands I have received from Mr. T. G. Sloane, of Sydney, the information that having (in compliance with my request) compared the following species with *Phlœocarabus Mastersi*, Macl., he thinks they are generically distinct. I do not doubt the correctness of Mr. Sloane's opinion, and am very glad to have received it in time to insert this note in the present memoir. Nevertheless, since these species undoubtedly present the characters attributed to *Phlœocarabus* in the published diagnosis of the genus, I think I do right in calling them by the name, and leaving them to bear it until the genus is re-characterized. I may say that Mr. Sloane draws attention to the much smaller size of the 2nd joint of the antennæ, and the wider and more *Xanthophœa*-like head in *Phlœocarabus*.]

PHLŒOCARABUS UNIMACULATUS, sp.nov.

Sat elongatus; sat depressus; minus nitidus; testaceus, capite prothoraceque plus minus rufescentibus, elytris macula magna communi nigra antrorsum in sutura producta ornatis; capite prothorace longiori, subtiliter sat sparsim punctulato; prothorace capite vix latiori, quam longiori vix latiori, basi quam antice paullo angustiori, canaliculato, transversim subtilissime strigoso, latitudine majori paullo ante medium posita, angulis (anticis subrotundatis) posticis distinctis obtusis, lateribus sat rotundatis pone medium vix sinuatis; elytris sat fortiter striatis, apice singulatim late rotundatis, interstitiis subconvexis, striis latera versus obsoletis. [Long. $2\frac{4}{5}$, lat. 1 line.

Var. Elytris juxta scutellum utrinque macula parva fusca ornatis.

The spot on the elytra is diamond-shaped, but when closely examined its outline is seen to consist of about 16 distinct lines, so that it is really a 16-sided figure; it extends laterally two-thirds (or in some examples half) across each elytron; its hind point is about $\frac{1}{5}$ of the length of the suture from the apex of the same and is produced (gradually narrowing) forward to a point

not much behind the scutellum. The width across the prothorax is scarcely half as great as across the elytra.

S. Australia; Adelaide; also near Port Augusta.

PHLŒOCARABUS UMBRATUS, sp.nov.

Minus elongatus; minus depressus; minus nitidus; testaceus, capite antice (et abdomine maculatim) infuscatis, elytris pone medium fascia lata angulata fusca (latera haud attingenti) ornatis; capite prothorace longiori, subtilissime vix manifeste punctulato; prothorace capite paullo latiori, quam longiori quarta parte latiori, basi quam antice sat angustiori, canaliculato, transversim subtilissime strigoso, latitudine majori paullo ante medium posita, angulis (anticis rotundatis) posticis distinctis obtusis, lateribus sat rotundatis pone medium sinuatis; elytris minus fortiter striatis, apice conjunctim rotundato-truncatis, striis latera versus obsoletis, interstitiis planis. [Long. $2\frac{3}{5}$-$3\frac{1}{5}$, lat. 1-$1\frac{1}{5}$ lines.

The lateral extension of the fascia on the elytra is somewhat greater than of the spot on the elytra of *P. unimaculatus*, its front margin is angulated on the suture (which it crosses slightly in front of the middle) and also on each side of the same; it is not extended up the suture farther forward than it is at the lateral angulations; its hind margin is angulated on the suture and also at two or three points on either side, the sutural angulation extending furthest back (in some examples nearly to the apex) the lateral angulations being successively less prolonged hindward; in some examples fine fuscous lines run out hindward at intervals along the hind margin of the fascia.

A distinctly wider and less depressed species than the preceding, the prothorax distinctly transverse and distinctly more than half as wide as the elytra with front angles evidently less produced forward and the width at the base evidently less in proportion to the width of the front; the pattern on the elytra very different and the interstices of the same much flatter.

Near Adelaide; usually in flood refuse.

PHLŒOCARABUS CRUDELIS, Newm. sp.

(? *Dromius crudelis*, Newm.).

The insect to which I have applied this name is probably identical with that on which the brief description of *Dromius crudelis*, Newm., was founded. That description deals only with colour and markings,—and those only in very general terms. If I should prove to be wrong in this identification there will be no harm done as in that case the probability is that Newman's insect is not a *Phlœocarabus*, and then both names can stand.

The species before me will be thus characterized:—

Sat elongatus; sat depressus; minus nitidus; testaceus; capite supra, elytrorum macula (forma complicata) magna, et sternis abdomineque latera versus (hoc apice quoque), nigris; capite prothorace longiori, confertim subtiliter rugato; prothorace capite vix latiori, quam longiori vix quarta parte latiori, basi quam antice sat angustiori, canaliculato, transversim subtilissime strigoso, latitudine majori paullo ante medium posita, angulis (anticis rotundatis) posticis distinctis obtusis, lateribus sat rotundatis pone medium sinuatis; elytris sat fortiter striatis, apice singulatim late rotundatis, interstitiis subconvexis. Long. $3\text{-}3\frac{2}{5}$, lat. $1\text{-}1\frac{1}{5}$ (vix) lines.

The black patch on the elytra occupies the greater part of the surface; the hinder portion resembles the dark fascia of *P. umbratus* but is extended nearly to the lateral margins; the middle of the anterior edge, however, of that fascia is continued widely forward and then again dilates into a large quadrate patch almost or quite touching the base. It should be noted that the prothorax is *reddish* testaceous, the other pale parts *yellowish*.

Apparently common in various parts of S. Australia; it occurs also in Western Australia.

ECTROMA, gen.nov.

In the Berliner Ent. Zeit. 1873, p. 54, note, the Baron de Chaudoir stated that *Cymindis inquinata*, Er., *Dromius tridens*,

Newm., and *Lebia benefica*, Newm., and *civica*, Newm., require the foundation of a new genus near *Sarothrocrepis*. De Chaudoir's lamented death rendered abortive the intention he appears to have entertained of dealing further with the subject at a later date, and I cannot find that any other author has dealt with it; I therefore propose for this genus the name *Ectroma*. The species from King's Sound described by Sir William Macleay under the name *Sarothrocrepis* probably belong to this new genus, which differs from *Sarothrocrepis* by the intermediate tarsi in the male not dilated nor bearing (except on the apical joint) a dense clothing of hairs beneath, by the shorter labrum, the apical joint of the labial palpi not "compressed, dilated and truncate at the apex," and the ligula longer as compared with its paraglossæ. Like *Sarothrocrepis*, its mentum has a long median tooth (which however is more pointed), the 4th joint of the tarsi is bilobed, the claws are pectinate, and in the male the apical ventral segment has the apical margin nicked in the middle. The genus is extremely near *Lebia*, but differs in the well-defined tooth of its mentum. From *Eulebia*, Macl., it differs by the less strongly dilated 4th joint of the tarsi, and from *Lachnoderma*, Macl., by the non-securiform apical joint of the labial palpi.

Sarothrocrepis suavis, sp.nov.

Sat brevis; glabra; nitida; pallide testacea, elytris postice plaga magna communi nigra ornatis; capite prothoraci longitudine sat æquali, subtiliter coriaceo; prothorace capite dimidia parte latiori, quam longiori plus dimidia parte latiori, basi quam antice vix tertia parte latiori, subtiliter canaliculato, supra obscure transversim strigoso, latitudine majore mox ante medium posita, angulis anticis rotundatis, posticis rotundato-obtusis, lateribus leviter rotundatis pone medium sinuatis, sat late deplanatis; elytris sat fortiter striatis, apice oblique sinuato-truncatis, interstitiis leviter convexis. [Long. $2\frac{2}{5}$, lat. $1\frac{1}{5}$ lines.

Maris palporum labialium articulo ultimo sat fortiter dilatato-compresso, haud securiformi, apice truncato; segmento ventrali apicali medio fortiter subtriangulariter emarginato; tarsorum

anticorum articulis basalibus 4 dilatatis subtus sat dense squamosis, intermediorum vix dilatatorum articulo primo apice 3que sequentibus subtus squamosis.

The black spot on the elytra is sharply defined and very conspicuous; it touches the apex in a point on the suture, thence its outline runs in a sinuate curve forward and outward on either side nearly to the lateral margin at a point considerably behind its middle, whence it turns towards the suture parallel to the base of the elytra to about the 5th stria, thence it runs up the elytron (but obliquely towards the suture) to a point not very much behind the middle of the same, and almost on the 4th stria where it makes a round turn and runs obliquely down the elytron to the suture. The prothorax, compared with that of *S. posticalis*, Guér., is more transverse and less narrowed in front and has the hind angles more rounded off. The black spot on the elytra somewhat resembles in form that on the elytra of *S. corticalis*, but is of less zigzag outline, extends much less forward, and is very much more sharply defined and conspicuous.

Port Lincoln, S.A.; also near Adelaide.

COPTODERIDES.

PHILOPHLŒUS EUCALYPTI, Germ.

This species is unsatisfactorily treated by de Chaudoir in his "Mem. sur les Coptoderides," 1869. The description of it is limited to the statement that it is very close to *intermedius*, Chaud., and differs from the latter in a few specified characters among which the piliferous punctures of the prothorax are not included. In *intermedius* they are said to be only two on each side. In describing *P. obtusus* the author states that "as in *Eucalypti*" there are only 2 piliferous punctures on either side, but a little further on we are informed that *P. planus*, Newm., has 4 piliferous punctures on either side "placed as in *Eucalypti*." As it is quite impossible to make anything of de Chaudoir's remarks on this species, and as there can be little doubt that a well known species occurring commonly in many parts of S. Australia is that which Germar had before him, I subjoin a description of this latter, which I am

quite satisfied is the true *Eucalypti;* it is probably the species that de Chaudoir calls by the name.

Pubescens; sat parallelus; testaceus vel rufo-testaceus; elytris (marginibus lateralibus et vitta discoidali postice gradatim attenuata testaceis exceptis) nigro-piceis, abdominis apice infuscato; prothorace utrinque punctis setigeris 5 instructis, angulis posticis vix distinctis; elytris modice (ut *P. australis*) punctulatis substriatis, interstitiis leviter convexis. [Long. $4\frac{3}{5}$-$5\frac{1}{5}$, lat. 2-$2\frac{1}{5}$ lines.

Maris tarsorum intermediorum articulis 1° (apice) et 2° subtus spongiosis.

Apart from the sexual characters this species is excessively close to *P. australis,* Dej., from which it differs as follows:—its average size is distinctly smaller; its prothorax is very evidently shorter (being slightly more than $\frac{2}{3}$ again as wide as its length down the middle) and is a little more emarginate in front; the yellow lateral margin of the elytra is wider (especially a little behind the base where it is more than half as wide as the interval between it and the juxta-sutural yellow vitta) and the juxta-sutural vitta is shorter (scarcely reaching into the apical $\frac{1}{5}$ of the elytron), with its hinder part gradually and strongly narrowed. The punctuation scarcely differs from that of *C. australis,* Dej. The suture is narrowly rufo-testaceous, this colour being a little dilated immediately behind the scutellum.

Of the previously described species of *Philophlœus* having the 3rd joint of the intermediate tarsi not spongiose below and the elytra with markings of the same type as those of *P. australis,* only two others have 4 or 5 setigerous points on the border of the prothorax and these (*puberulus,* Chaud., and *quadripennis,* Chaud.), have the puncturation finer and denser than in *P. australis,* while the former has the juxta-sutural yellow elytral vitta not at all narrowed ("nullement *amincie*") hindward, and the latter *inter alia* has the prothorax less strongly emarginate in front than that of *P. australis.* I have seen a fairly long series of both sexes and find scarcely any variation.

S. Australia; I have not seen specimens from further East than Yorke's Peninsula.

PHILOPHLŒUS FUSCIPENNIS, Germ.

This name should drop out of the Catalogue, as the description is certainly insufficient for positive identification, and it refers almost certainly to one of the insects described by the Baron de Chaudoir in 1869; the Baron thought it to be probably his *immaculatus* or *planus*. It appears to me more likely to be his *unicolor*, but as there seems to be no probability of arriving at any certainty on the point it would be better to treat the name as though it were non-existent.

PHILOPHLŒUS PLANUS, Chaud.

My collection contains a good many specimens which appear to appertain to this species. Unfortunately the description does not give any account of the colour of the prothorax. In my examples this segment is unicolorous with the elytra, having like them, a pale border. De Chaudoir also omits mentioning the colour of the elytra, merely remarking that they are devoid of pattern. My examples have brown elytra with a pale border. According to the description this species is distinguished from *unicolor inter alia* by its smaller size, but my largest examples are not smaller than the smallest measurements given for *unicolor*. The shortness of the elytra in proportion to their breadth, the evidently greater concavity of the front outline of the prothorax, and the greater contraction of this segment behind making the hind angles less marked appear however to be good characters, but (as de Chaudoir says) the two species are certainly very close to each other. I find that the number of piliferous punctures on the sides of the prothorax varies from 4 to 6.

PHILOPHLŒUS OPACICEPS, sp.nov.

Pubescens; minus parallelus; testaceus vel rufo-testaceus; elytris (marginibus lateralibus exceptis) et abdominis marginibus lateralibus, infuscatis; capite subtiliter coriaceo et sparsius subtilius leviter punctulato; prothorace transverso subcordato, antice

fortiter emarginato, angulis posticis distinctis subrotundatis, basi bisinuata media parte late leviter lobata; elytris creberrime subtilissime punctulatis. [Long. $3\frac{4}{5}$-$4\frac{1}{2}$, lat $1\frac{4}{5}$-2 lines.

Maris tarsis intermediis simplicibus.

This species seems intermediate between *Philophœus* and *Agonocheila*,—the latter of which Baron de Chaudoir himself stated to be in strictness a mere subsection of *Philophlœus*. Its tarsi are of *Agonocheila;* in other respects it is a *Philophlœus*. It differs from all its described allies in its head being subopaque through minute coriaceousness, and also sparingly sprinkled with faintly impressed punctures. The prothorax is extremely like that of *P. unicolor*, Chaud., but is slightly less transverse, with the front margin much more strongly concave and the hind angles a little less defined. The puncturation of the elytra is much finer and closer than in any other of the species of *Philophlœus* having elytra without discal markings. From *planus* and *unicolor* it differs by its less parallel form. Its superficial resemblance to *P. immaculatus*, Chaud., is most extraordinary; but it differs from it in the sculpture of the head and elytra, in the less transverse prothorax (which is more strongly emarginate in front), and in the sexual characters of the male. The sides of the prothorax bear two or three setæ in front of the middle, one close to the middle, and one at the basal angle.

S. Australia; under bark of Eucalyptus at Moonta, Port Augusta, and Port Lincoln.

AGONOCHEILA CRIBRIPENNIS, Chaud.

I possess specimens agreeing perfectly in respect of colour and markings with the description of this insect, but which are certainly only varieties of *A. lutosa*, Newm. Baron de Chaudoir says that *cribripennis* differs from *lutosa* in the puncturation of the elytra (which these examples do not, at any rate not in any invariable manner) as well as in colour and markings, and implies that there are some other distinctions (*e.g.*, in the erect hairs of the prothorax), so it is quite *possible* that *cribripennis* is

a good species, closely resembling in colour and markings some varieties of *lutosa*. My collection contains several specimens intermediate in markings between those referred to above and typical *lutosa*, and some in which the dark markings are still more reduced till they consist of a mere infuscation of the front of the suture and a faint shading near the lateral margin. The species is common in South Australia.

SCARITIDES.

PLATYTHORAX (CARENUM) TRANSVERSICOLLIS, Chaud.

Sat nitidus; lævis; niger, elytris violaceo-marginatis; capite lato, brevi, supra oculos unipunctato; sulcis frontalibus profundis sat parallelis, antice fortiter divergentibus, postice quatenus oculi productis; prothorace quam longiori fere duplo latiori, antice quam postice vix latiori, leviter canaliculato, angulis anticis productis, posticis bene determinatis nihilominus rotundatis, basi bisinuata in medio nullo modo concava; elytris prothoraci latitudine æqualibus, sat late reflexo-marginatis, antice truncatis, suturam versus conjunctim late leviter concavis, tibiis anticis externe tridentatis. [Long. 9, lat. $3\frac{1}{5}$ lines.

The prothorax is scarcely less (as 8 to $4\frac{1}{2}$) than twice as wide as its length down the middle. The basal lobe (which is wide and well-defined, though not much produced hindward) has its hind outline evenly convex all across—not at all concave or emarginate in the middle. The elytra are separately convex transversely—so that if their upper outline be viewed, looking from the head across the prothorax, it appears to be widely and feebly but evidently concave in the middle. [It is quite possible that this may be caused merely by slight immaturity.] The row of punctures on the declivous front margin of the elytra contains 3 on each side placed close together on the external half of the base, and a row of punctures runs just within the lateral margin, but the discoidal punctures of the elytra are entirely wanting. On the anterior tibiæ the teeth resemble those of *Calliscapterus campestris*, Macl. The inferior ridge reaches the tarsus.

The absence of discoidal elytral punctures approximates this species to *Carenum ineditum*, M. ., and some others which have only two teeth on the externa rgin of the front tibiæ. Its nearest ally, however, appears *C. Macleayi*, Blackb., from which it differs (independently our) by the longer frontal sulci of its head; its wider prothor. the hind angles of which are less rounded off—the base being a gently bisinuate line as long as, and (along its whole length) parallel to, the front margin; and its elytra narrower anteriorly.

McDonnell Ranges, Central Australia; taken by Mr. A. S. Wild.

N.B.—The above species appears to be identical with *Carenum transversicolle*, Chaud., but as its author has not described that species, having done little more than mention some of its differences from its allies, I think it is well to furnish a formal description.

CLIVINA BOVILLÆ, sp.nov.

Minus angusta; minus parallela; minus convexa; subtus picea; supra obscure ferruginea, maculatim vix distincte infuscata, antennis palpis pedibusque testaceo-brunneis; prothorace postice quam antice fere tertia parte latiori, basi utrinque lineatim impresso, quam longiori vix latiori; elytris fortiter striatis, striis sat fortiter punctulatis, stria 4ª basi extrorsum contorta; clypeo ad latera rotundato vix producto; tibiis anticis externe dentibus 4 instructis, dente summo parvo, 2° sat magno, 3° majore etiam, apicali ceteros longitudine superanti. [Long. $3\frac{1}{5}$, lat. $\frac{4}{5}$ lines (vix).

This species may be placed in the "section" of M. Putzeys' "Revision Gen. des Clivinides" in which the author places *C. Australasiæ*, *C. vagans*, &c. The clypeus is only very gently concave in front, those parts which M. Putzeys calls its "wings" being scarcely defined but being fairly distinct from what he calls the "large wings" of the head. The structure of these parts is not unlike the same in *C. melanopyga*, Putz., but the front of the clypeus is even less concave. The portion of the head behind the clypeus is vaguely impressed down the middle, and its front part

is comparatively strongly punctured. The interstices of the elytra are rather strongly convex, [illegible]ewhat more so than in *C. melanopyga*, the striæ being n[illegible]e so distinctly punctured as in that species. The externa[illegible] of the anterior tibiæ are considerably longer and more sle[illegible]han in *C. melanopyga*, the 4th (*i.e.*, the uppermost) though s[illegible]l and blunt being quite well defined. The apical spine on the inner margin of the same tibiæ is much larger in the male than in the female. The flanks of the prosternum are oqaque on a sharply limited space (owing to the presence of close longitudinal strigosity), the opaque space also bearing some transverse strigæ which are much more continuous and deeply impressed than the longitudinal ones. This sculpture is exceptionally strongly developed,—much more so *e.g.* than in *C. melanopyga*.

N. Territory of S. Australia; taken by Mrs. Bovill.

CLIVINA ÆQUALIS, sp.nov.

Sat angusta; sat parallela; sat convexa; picea; antennis, palpis, elytris, pedibusque, plus minus ferrugineis; prothorace postice quam antice vix latiori, basi utrinque haud lineatim impresso, quam longiori paullo latiori; elytris fortiter striatis, striis sat fortiter punctulatis, stria 4^a basi extrorsum contorta; clypeo ad latera rotundato vix producto; tibiis anticis externe dentibus 4 instructis, dente summo parvo, 2^o sat magno, 3^o majore etiam, apicali ceteros longitudine superanti.

[Long. $2\frac{3}{5}$, lat. $\frac{3}{5}$ line.

Resembles the preceding, but differs as follows:—it is a little more elongate, parallel and convex; the head and prothorax are of a darker colour; the clypeus is flatter and still less distinct from its "wings;" the part which M. Putzeys calls the "anterior elevation" being not distinctly raised, and having no transverse furrow behind it; the head is wider and less shining; the prothorax is slightly wider in proportion to its length, being by measurement slightly transverse (to the eye it appears scarcely so), it is scarcely at all narrowed forward, the sides are strongly wrinkled transversely except near the front, the longitudinal

linear impression near the base on either side is entirely wanting, the central longitudinal channel is much stronger; the striæ of the elytra are much more conspicuously punctulate except near the apex, the external teeth on the anterior tibiæ are even longer; the tarsi (especially the hind ones) are much more slender.

N. Territory of S. Australia; taken by Mrs. Bovill.

Clivina dorsalis, sp.nov.

Sat angusta; sat parallela; minus convexa; picea; antennis, palpis, mandibulis (apice excepto), clypei lateribus, elytris latera versus, pedibusque, testaceis; prothorace postice quam antice vix latiori, basin versus utrinque lineatim longitudinaliter fortiter impresso, quam longiori vix latiori, sat fortiter punctulato; elytris fortiter striatis, striis sat distincte punctulatis, stria 4^a basi haud extrorsum contorta; clypeo ad latera breviter acute dentato; tibiis anticis externe dentibus 3 (dente 4° obsoleto) instructis.

[Long. $2\text{-}2\frac{2}{5}$, lat. $\frac{2}{5}\text{-}\frac{3}{5}$ line.

The pallid colouring on the elytra is very variable, in some instances being almost obsolete, in others (perhaps immature) occupying the whole surface; in average specimens the elytra bear 3 stripes of about equal width, the middle one common and piceous, the lateral ones pallid.

Apparently near *C. suturalis*, Putz., but differing from it in the prothorax being (by measurement) not at all longer than wide, and in the 4th stria not being deflected outwards at the base to meet the 8th stria which, however, meets the 5th stria, as in *C. melanopyga*.

Port Lincoln; also near Adelaide.

Clivina boops, sp.nov.

Minus angusta; parallela; convexa; nigra; antennis, palpis, mandibulis (apice excepto), clypei lateribus, pedibusque, rufis; capite lato; prothorace postice quam antice haud latiori, basi utrinque nullo modo (nonnullis exemplis obsoletissime) lineatim

longitudinaliter impresso, quam longiori fere quarta parte latiori, sat fortiter rugato latera versus sat fortiter punctulato; elytris sat fortiter striatis, striis sat fortiter punctulatis omnibus antice liberis,—plurimis postice obsoletis, interstitiis minus convexis; clypeo utrinque rotundatim minime ultra alam producto; tibiis anticis externe dentibus 4 (ut *C. æqualis*) instructis; menti dente medio sat acuto sat elongato. [Long. $3\frac{1}{5}$, lat. $\frac{4}{5}$ line.

Var. (? immat.) Corpore toto testaceo.

The distinguishing features of this species are:—tooth of mentum somewhat pointed and not much shorter than the lateral lobes of the same; wide head (evidently across the eyes, which are little convex, more than three-quarters the width of the prothorax); clypeus roundly prominent on either side and slightly more prominent than the lateral wings which are clearly distinct from it; vertex strongly punctulate on a space of variable size,—body of even width from the front of the prothorax to near apex of elytra; prothorax by measurement nearly a quarter (to the eye scarcely) wider than long and having its surface strongly wrinkled transversely and punctured towards the sides, without any longitudinal line impressed on either side near the base, no two elytral striæ distinctly connnected in front, &c., &c.

Port Lincoln; also near Adelaide.

Clivina Adelaidæ, sp.nov.

Sat angusta; parallela; minus convexa; nigra; antennis, palpis, mandibulis (apice excepto), clypei lateribus, pedibusque, plus minus rufescentibus; prothorace postice quam antice vix latiori, postice utrinque lineatim longitudinaliter impresso, sat lævi, longitudine latitudini æquali; elytris sat fortiter striatis, striis punctulatis, stria 4ª basi extrorsum contorta, interstitiis minus convexis; clypeo utrinque obsoleto minime ultra alam producto; tibiis anticis externe dentibus 4 (ut *C. æqualis*) instructis.

[Long. $3\frac{2}{5}$, lat. $\frac{4}{5}$ line.

Var. (? immat.) Minor, corpore toto testaceo.

Resembles *C. boops* but is much more elongate with the prothorax very much narrower, 4th stria of elytra curved outward at the base to join the 8th.

Adelaide district.

Clivina tuberculifrons, sp.nov.

Sat angusta; minus parallela; minus convexa; ferruginea; capite inter oculos bituberculata; prothorace postice quam antice fere tertia parte latiori, postice utrinque lineatim longitudinaliter impresso, sparsim obscure rugato, longitudine latitudini æquali; elytris sat fortiter striatis, striis punctulatis, stria 4ª basi extrorsum contorta, interstitiis vix convexis; clypeo utrinque vix ultra alam producto; tibiis anticis externe dentibus 4 (ut *C. æqualis*) instructis. [Long. 2. lat. ½ line.

Distinguished from all the previously described Australian species of *Clivina* by the protuberance on either side of the frontal impression, and from nearly all by its diminutive size.

Clivina Wildi, sp.nov.

Minus angusta; minus parallela; sat depressa; picea, prothorace rufescenti, antennis, palpis, pedibusque, testaceis; prothorace postice quam antice quarta parte latiori; basi utrinque leviter lineatim longitudinaliter impresso, quam longiori vix latiori; elytris fortiter striatis, striis fortiter punctulatis, stria 4ª basi extrorsum haud contorta, interstitiis convexis; clypeo utrinque ultra alam producto; tibiis anticis externe dentibus 3 (dente 4° obsoleto) instructis.

[Long. $2\frac{1}{5}$, lat. $\frac{3}{5}$ line (vix).

The 5th (not 4th) stria connecting on the base of the elytra with the external stria, together with the small size of the insect, and the uppermost tooth of the anterior tibiæ scarcely indicated will distinguish this from the previously described species.

McDonnell Ranges, Central Australia; taken by Mr. A. S. Wild, an intrepid explorer to whom I have much pleasure in dedicating this interesting little species.

CLIVINA DEBILIS, sp.nov.

Sat angusta; sat parallela; minus depressa; nigra; antennis, palpis, mandibulis (apice excepto), clypei lateribus et pedibus, testaceis; prothorace postice quam antice vix latiori, postice utrinque lineatim longitudinaliter impresso, sat lævi, longitudine latitudini æquali; elytris sat fortiter striatis, striis fortiter punctulatis postice subobsoletis, stria 4^a basi haud extrorsum contorta; interstitiis sat planis; clypeo utrinque haud ultra alam (hac vix distincta) producto; tibiis anticis externe dentibus 3 (dente 4° obsoleto) instructis. Long. $2\frac{1}{5}$, lat. $\frac{3}{5}$ line (vix).

Var. (?) Minor (long. 2 lines), dilutior, paullo minus convexa.

The 5th (not the 4th) stria connecting at the base with the 8th distinguishes this species from most of its congeners; from the rest it may be separated by the front outline of the clypeus not projecting on either side beyond the "wings," the prothorax having a distinct longitudinal impressed line on either side near the base, and the uppermost (4th) tooth of the anterior tibiæ being scarcely indicated.

Port Lincoln. The var. ? occurs near Adelaide.

CRATOCERIDES.

PHORTICOSOMUS RANDALLI, sp.nov.

Piceo-brunneus; nitidus; antennis, labro, palpis, pedibusque, rufescentibus; prothorace obsolete canaliculato, antice subtruncato, postice quam antice haud angustiori, angulis posticis rotundatis; elytris sat fortiter striatis, striis latera versus gradatim obsoletescentibus. [Long. 6, lat. $2\frac{2}{5}$ lines.

Closely allied to *P. felix*, Schaum, and *P. brunneus*, Blackb. From the former it differs in the colour of the antennæ, in the prothorax almost truncate in front, with hind angles quite rounded off, and a distinct flattened transverse space in front of the base (as in *P. brunneus*) and in the elytral striæ becoming quite feeble towards the lateral margins. From *P. brunneus* it

differs by its considerably larger size, prothorax not narrowed behind and having the hind angles rounded off, and by the enfeebling of the lateral striæ on the elytra. All the other previously described species are either very much larger or very much smaller, except *P. Nuytsii*, Cast., from Western Australia, which is described as a black insect with the prothorax almost rectangular behind.

N. Territory of S. Australia; taken at Barrow's Creek by Mr. W. D. Randall, to whom I have dedicated it.

TRIGONOTOMIDES.

ABACETUS.

It seems at least *doubtful* whether the Australian species attributed to *Abacetus* and to *Drimostoma* are generically distinct *inter se*. Baron de Chaudoir (Bull. Mosc. 1870, p. 375), expresses the opinion that *D. vicina*, Cast., may be even *specifically* identical with his (de Chaudoir's) *A. australis*, but makes no comment on Castelnau's other species. Another of the insects referred (though in this case doubtfully) to *Drimostoma* by Castelnau (*D. ? tasmanica*) is asserted by Bates (Cist. Ent. II. 321) to be an *Oopterus*, a genus which Lacordaire associates with *Cnemacanthus*. Of the remaining four of Castelnau's *Drimostoma*, one (*Thouzeti*) is said to be very like *vicina* from which it is perhaps safe to infer that de Chaudoir would have called it an *Abacetus*. The rest are from the mountains of Victoria; *D. australis* may be almost anything,—if it be congeneric with *D. vicina* it would necessitate a new name for *Abacetus australis*, Chaud.; *D. montana* from the description (*e.g.* "thorax not marginated laterally") cannot have anything to do with *Drimostoma*, and the same remark would probably apply to *D. alpestris*, which is said to be very like *D. montana*, but the description is so worthless that unless the type can he referred to its identification is hopeless.

According to de Chaudoir *Drimostoma* and *Abacetus* resemble each other very closely in facies,—but that learned writer mentions as the main distinction between them that in the former the

lobes of the mentum are pointed at the apex, while in the latter the lobes of the mentum are rounded at the apex. Both genera were founded by Dejean for African species, some American insects having been doubtfully attributed afterwards to *Drimostoma* and some from the European coasts of the Mediterranean having been attributed to *Abacetus*. M. de Chaudoir expresses doubt as to *Drimostoma* being found in Australia (Ann. Soc. Ent. Belg. Vol. XV.).

I have in my collection a single example each of two species from the Northern Territory of S. Australia which appear to be congeneric with *Abacetus australis*, Chaud., but as the description of that insect merely states the colour and then points out the specific differences between it and *R. flavipes*, Thoms., (from Gaboon), giving no account of the structural characters, I think I shall do well to enumerate some of the characters of the present insects to prevent any inconvenient results in case I should prove to be wrong in supposing them congeneric with de Chaudoir's species.

They both belong to the group which Lacordaire calls "*Trigonotomides*" having the mentum (which drops very abruptly below the plane of the submentum and is separated from it by a strong carina) narrowed forwards, with its front margin only sinuated. The submentum is of peculiar structure, the middle part being a flattened plate bearing three strong longitudinal carinæ pointed in front, on either side of which it (the submentum) becomes somewhat declivous and is limited by a curved keel; the lateral portions of the mentum have a crimped appearance. I have not been able to examine the mentum satisfactorily except with a compound microscope, but probably if a specimen could be spared for the palpi to be removed it might be done with a Coddington lens. Of the maxillary palpi the 2nd and 4th joints are subequal, the 3rd being shorter; the 2nd is depressed and dilated, the 3rd is gradually dilated from the base to the apex and the 4th is narrowed from the base to the apex, these palpi thus not differing very much from those of *Simodontus* except in the second joint being considerably more dilated. Of the labial palpi the 2nd joint

is slightly longer than the 3rd of the maxillary and is slightly dilated from the base outwards, while the third joint is scarcely shorter than the 2nd and is slightly thickened for a little distance from the base and then attenuated towards the apex, the labial palpi thus scarcely differing from those of *Simodontus*. The prosternum has a wide shallow sulcus down the middle from a little behind the front nearly to the apex; it protrudes a little behind the front coxæ, the protruding part being carinate round its free margin and bearing two strong foveæ on its surface. The intermediate ventral segments bear a large setigerous puncture on either side of the middle line, and are not furrowed transversely. The apical ventral segment in the female bears 4 setigerous punctures along the hind margin,—in the male only 2 punctures which however are very large ones. In the male the anterior tarsi are but little dilated and the basal ventral segment is concave down the front part of the middle line. [It must be remembered that the male and female appertain to very widely distinct species]. The very much lower plane of the mentum as compared with that of the submentum as well as the shape of the former in front, separate these two species widely from all the small Australian *Feronides* known to me. The episterna of the metathorax carry a well defined sulcus immediately within their margin all round so that their edge appears finely ribbed. I cannot discover any suture separating off from the episternum an apical piece (the epimeron); at the apical end of the episternum, however, the marginal sulcus is much further within the border than elsewhere, and I take the portion beyond it to be the epimeron. The episternum (including this piece) is not much less than twice as long as its width in front which slightly exceeds the width of the widest part of the elytral epipleuræ. The mandibles are nearly straight to near the apex where they are incurved and sharply pointed. The labrum is transverse, truncate in front. The head bears a strong transverse sulcus a little behind the labrum; the two ends of the sulcus turn at an angle and run backward on the head, diverging in a curve to the eye; a large deep impression on either side is bounded externally by these

curved lateral sulci. The antennæ when set back reach considerably beyond the base of the prothorax; they are moderately stout, the 2nd joint short, the rest subequal. The lateral gutter of the prothorax immediately within the turned up edge is wider and stronger than in most of the small *Feronides (e.g. Simodontus)* and is continued within the basal angle and a short distance along the base, and then turns and runs forward on the prothorax, forming an extremely strong sulcus. The 3rd interstice of the elytra bears a single puncture at about the middle of its length In one of my examples the 3rd interstice has another puncture near the front on one elytron only. There is no trace of an abbreviated scutellar stria.

The facies is not unlike that of *Loxandrus.*

ABACETUS SIMPLEX, sp.nov.

♀. Niger, subiridescens; antennis, palpis, pedibusque, rufescentibus; prothorace quam longiori tertia parte latiori, antice quam postice sat latiori, medio longitudinaliter fortiter sulcato, antice leviter emarginato, angulis anticis distinctis parum productis, lateribus sat fortiter rotundatis pone medium leviter sinuatis, angulis posticis acute rectis subdentatis, sulco laterali sat lato, sulco utrinque basali sat elongato; elytris fortiter striatis, striis lævibus, interstitiis minus convexis. [Long. 3, lat. 1 line.

N. Territory of S. Australia; taken by Dr. Bovill.

As I have not a type of *A. flavipes,* Thoms., I cannot form a very clear notion of *A. australis,* Chaud., but this species seems to differ from it, *inter alia,* in being iridescent and having antennæ of a uniform red colour. It is larger than any of the species of *Abacetus* that have been described by Sir W. Macleay, those nearest it in size, moreover, having the striæ of the elytra punctured. *Drimostoma Thouzeti* and *vicina,* Cast., have dark antennæ, with only the base pale.

ABACETUS CRENULATUS, sp.nov.

♂. Niger; antennis, palpis, pedibusque rufescentibus; prothorace quam longiori plus tertia parte latiori, antice quam postice

parum latiori, medio longitudinaliter profunde sulcato, antice parum emarginato, angulis anticis obtusis, lateribus fortiter rotundatis mox ante basin sinuatis, angulis posticis minutis subdentiformibus, sulco laterali lato profundo, sulco utrinque basali minus elongato; elytris profunde striatis, striis fortiter crenulatis, interstitiis fortiter convexis. [Long. $2\frac{1}{2}$, lat. 1 line (vix).

Differs from *A. simplex* by its shorter and wider prothorax of which the sulcus within the lateral margin is much stronger, and by its still more deeply striate elytra, the striæ of the same being crenulate internally, and the interstices very much more convex; the legs (especially the hind femora) are of a darker colour. From *A. australis*, Chaud., and *D. Thouzeti* and *vicina*, Cast., it differs by its unicolorous antennæ and smaller size. Of Sir W. Macleay's species only *A. ater* and *A. angustior* are described as not having the elytral striæ simple; from the former of these it differs by its elytra much wider than the prothorax, and from the latter by its prothorax not "longer than the width." The median sulcus of the prothorax (as in *A. simplex*) is abbreviated at both ends.

N. Territory of S. Australia; taken by Dr. Bovill.

ABACETUS A. MACLEAYI, sp.nov.

A. flavipes, Macl., (nom. præocc.)

The above change in nomenclature seems to be required.

FERONIDES.

PROSOPOGMUS.

Masters' Catalogue attributes 10 Australian species to this genus (or sub-genus), of which at most 3—*Boisduvali*, Cast., *Reichei*, Cast., (these two probably not specifically distinct *inter se*), and *harpaloides*, Chaud.,—seem to be entitled to their place. The error has probably arisen from the fact that de Chaudoir (Ann. Mus. Gen. 1874, p. 594) has most unaccountably placed

under the heading "*Prosopogmus*" a list of all the *Feronides* of Castelnau of which he has ascertained the types to be lost, and Mr. Masters has included these in the genus *Prosopogmus.*

Pœcilus.

There appears to me to be no satisfactory evidence of the occurrence of any true *Pœcilus* in Australia, as no author in calling any Australian species by the name has mentioned as present that distinctive character of *Pœcilus*—the basal joint of the antennæ carinated. *P. Kingi,* W. S. Macleay, could not be identified without reference to the type. The descriptions of *P. lævis,* Macl., and *sulcatulus,* Macl., do not read like those of *Pœcili,* and that of *P. semiplicatus,* Cast., is quite useless. *P. chlænioides,* Macl., is stated by its author to resemble *P. resplendens,* Cast., which is a *Chlænioideus.*

Rhytisternus Bovilli, sp.nov.

Minus depressus; piceus, plus minus rufescens; prothorace quam longiori fere tertia parte latiori, postice utrinque bistriato; striis in excavatione vix manifesta positis, lateribus postice vix sinuatis, angulis posticis obtusis haud dentatis; elytris striis 5^a, 6^a, et 7^a plus minus obsoletis; tarsis posticis extus vix perspicue sulcatis. [Long. 6-6$\frac{2}{5}$, lat. 2$\frac{1}{5}$ lines.

Average specimens of this insect are of a shining pitchy red colour, but I have before me a single example the colour of which is almost uniformly pitchy black. The antennæ and legs are fairly robust, resembling those of *R. liopleura,* Chaud., (and therefore very different from those of *R. sulcatipes,* Blackb.). The frontal sulci diverge strongly behind as in *sulcatipes* (in *liopleura* they are nearly parallel). The prothorax is scarcely so wide in front as at the base (in *liopleura* the base is slightly narrower than the front, in *sulcatipes* the base and front are equal); it is nearly a third again as wide as its length down the middle being slightly more transverse than in *liopleura* and *sulcatipes;* the sides are a little

less strongly rounded than in *liopleura,* and behind the middle are scarcely sinuated (in *liopleura* they are decidedly sinuate, in *sulcatipes* not at all); the hind angles are obtuse but not far from rectangular, without the slightest indication of a tooth directed outward (in *sulcatipes* they are much more obtuse, making an angle of about 60°, in *liopleura* they are distinctly dentate and directed outward); the 2 longitudinal sulci at the base on either side are better defined and more distinct from each other than in either *liopleura* or *sulcatipes,* the space separating them being almost on the same plane as the general surface of the prothorax. The striæ of the elytra are almost as in *sulcatipes* being more strongly impressed than in *liopleura,* but the shoulders resemble those of *liopleura* being less produced forward than in *sulcatipes.*

I do not think that this insect is identical with any of those previously described, though it is difficult to be sure owing to the deplorably inferior quality of the descriptions of most of them. Here is an example :—if it is desired to ascertain whether a given specimen is *R. cyathodera,* Chaud., one turns to the description, so-called, of that insect and finds no actual description, but only a few notes on its differences from other species, commencing (I translate the Latin) "differs from *lævilatera* in its much wider and shorter prothorax, &c., &c.," but no positive statement of characters. Thus referred back again to *lævilatera* one turns up that species and reads again no *positive* description, but "differs from *liopleura* in its narrower prothorax, not narrowed behind, &c., &c." This reminds one of "the House that Jack built," the prothorax of *cyathodera* being thus described as "wider and shorter than that of *lævilatera* which is narrower than that of *liopleura;*" and from this tangle it would require a clearer mind than mine to evolve the prothorax of *R. cyathodera.* In this confusion I fear at the risk of being prolix that I must conclude by giving my reasons for not identifying *R. Bovilli* with any previously described species. From *liopleura* and *sulcatipes* I have already distinguished it; *lævilatera* is said to have the 5th stria on the elytra "*omnino obliterata,*" and the external basal sulcus of the prothorax less defined that in *liopleura; cyathodera* is said to be an iridescent

insect with the external basal sulcus of the prothorax almost obliterated, and its size is much larger; in *puella* the prothorax is said to be cordate; in *misera*, Chaud., the prothorax is said to be longer than in *liopleura* with the external basal sulcus "obsoletior," and it is implied that the hind angles are dentate; *angustulus*, Macl., seems from the measurements and name to be a much narrower species (though I regard its identity as *possible); limbatus*, Macl., appears to be much smaller and very differently coloured.

N. Territory of S. Australia; taken by Dr. Bovill.

Rhytisternus limbatus, Macl.

Last year I met with a single example of a *Rhytisernus*, in the neighbourhood of Lake Eyre, which agrees so well with the description of this remarkable insect that I can hardly doubt its identity, although the type was found at King's Sound, in N.W. tropical Australia. The only discrepancy I notice is in the colour of the antennæ which is described as "piceous," whereas the antennæ in my specimen are of a brownish testaceous colour. The prothorax scarcely differs in any respect from that of the preceding species *(R. Bovilli*, Blackb.) except in having the two basal furrows near the external margin on either side placed in a common impression as in *R. liopleura;* the circular form (from some points of view) of the outer of these (referred to by Sir W. Macleay) seems to be characteristic of the species. The elytra compared with those of *R. liopleura* are more strongly striated and have the humeral angles sharper,—more dentiform,—but not the shoulders more produced.

Leptopodus, Chaud.

This genus—proposed by the Baron de Chaudoir for *Pterostichus holomelanus*, Germ.,—has not been characterised so far as I can ascertain. The following characters will, however, suffice to distinguish it from other *Feroniæ*:—Basal joint of antennæ not carinate, 3rd interstice of elytra tripunctate, metathoracic

episterna (including the apical piece divided off by a fine suture) considerably longer than its front margin is wide, the front margin being considerably wider than the elytral epipleuræ, and no furrow running within the lateral margin; intermediate ventral segments transversely sulcate as in *Simodontus*, each ventral segment bearing two conspicuous setigerous punctures placed one on either side of (and near to) the middle, the apical segment of the female with an additional setigerous puncture on either side near the margin, prosternum produced widely and strongly behind the front coxæ, the free outline of the produced part edged with a carina, the tarsi externally sulcate, the anterior tarsi with the basal 3 joints in the male strongly dilated and furnished beneath each with two rows (meeting at the base and strongly diverging forward to enclose the base of the rows belonging to the next joint) of very conspicuous white scale-like papillæ, mentum with a wide strongly declivous median tooth, the front of which is arcuately concave in the middle and prominent at the ends.

I am unable to find any structural characters to distinguish this genus from *Simodontus* except the strong declivity of the median tooth of the mentum and the strongly sulcate tarsi. The vestiture of the anterior tarsi in the male does not seem to differ noticeably.

LOXANDRUS.

I doubt whether the Australian species attributed to this genus are really congeneric with the American species for which the name was established, as the mouth organs do not appear to me to tally satisfactorily with the description, but as I have not a type of any of the American species for comparison I shall not venture to propose a new name. I have before me examples from various parts of S. Australia, and some from the Northern Territory, which do not seem to be specifically different *inter se*, although they vary somewhat in size (long. $3\frac{4}{5}$-$4\frac{1}{2}$ lines), and in some the elytral interstices appear slightly more convex than in others. I should say that *Pœcilus iridescens*, Cast., is most probably this

species. A very notable character of the insect before me is the presence of strong puncturation on the metathoracic episterna and on the sides of the metathorax and ventral segments, such puncturation being coarse and not close in front, and becoming gradually finer and closer hindward. There seem to be no good characters mentioned to distinguish from it *Pœcilus interioris*, Cast., *P. subiridescens*, Macl., and perhaps even *P. atronitens*, Macl.; this latter having "only a trace of iridescence on the elytra," is quite possibly distinct. *Pterostichus lævigatus*, Macl., also must be very near it.

SIMODONTUS.

I have lately been trying to identify the insects on which some of the earlier descriptions of the smaller species of *Feronia* (in the wide sense) were made, and have found that it is simply impossible to arrive at any assurance by other means than a comparison with types that are certainly not in Australia, and many of which are almost certainly non-existent. Most of the smaller species of this group appertain to the genus (or sub-genus) *Simodontus*, Chaud., which is characterised in terms that are quite unintelligible, viz., "Elytra ad striam tertiam tripunctata. Cætera ut in *Orthomo*, thoracis angulis posticis rotundioribus." On referring to the description of *Orthomus* (as quoted by Dr. Schaum in the "Insecten Deutschlands;" I have not the original, which appeared in the Bull. Mosc. 1838) one finds no distinct assertion as to the puncturation of the elytra, but a statement of the characters which distinguish *Orthomus* from *Pœcilus* and *Adelosia* (species of both these having the 3rd interstice tripunctate), which does not mention any difference in respect of these punctures. In the absence of a reliable type of *Orthomus* I should be at a loss even to attribute any Australian insect confidently to *Simodontus* were it not that the Baron de Chaudoir has given a further clue in describing the *species* he has attributed to the genus.

The Baron de Chaudoir appears to regard *Argutor australis*, Dej., as the type of *Simodontus*, unfortunately a species quite

hopeless to identify with absolute certainty—at least in Australia. Dejean's description consists of 18 words, followed by a comparison of its subject with *F. barbara* (a species occurring on the eastern shores of the Mediterranean Sea); de Chaudoir (with exceptional facilities for comparison of types) is doubtful as to the insect it is founded on.

Next comes *Simodontus æneipennis*, Chaud., which is fairly well described; but a note at the end of the description says that "it is perhaps the *Feronia australis*, Dej."

In 1865 M. Motschoulsky described what is no doubt a *Simodontus* under the name (*Argutor ?*) *antipodum.* [I have not seen the description.]

In 1868 the Count de Castlenau described as *Feronia inedita* an insect which is probably either a *Simodontus* or a *Leptopodus* from the Pine Mountains of Queensland. De Chaudoir in his memoir on the Castelnau collection makes no reference to it, from which it is to be inferred that the type has perished. But the description is, I think, sufficient to enable its identification on a specimen taken in the locality cited if such should turn up, when a more scientific description may be furnished.

At the same time the Count described as species of *Harpalus* two insects (*Fortnumi* and *brunneus*) which in his report on Count Castelnau's collection de Chaudoir asserts to belong to *Simodontus.**

Three years later Sir William Macleay, in the "Insects of Gayndah," described as *Argutor* three species (*foveipennis, nitidipennis*, and *oodiformis*) which de Chaudoir says are *Simodontus*; of these fuller descriptions are desirable pointing out their distinctions from others of the genus.

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* I accidentally overlooked this note of de Chaudoir when in the Trans. Roy. Soc. S.A. x. p. 190, I expressed a doubt as to whether *H. Fortnumi* appertained to the *Harpalidæ*, but suggested that if of the sub-family at all it might be a form of *H. Deyrollei*. Mr. Masters also has evidently committed the same oversight in placing the two in *Harpalus*, in his "Catalogue of the described *Coleoptera* of Australia."

In 1873 de Chaudoir described 6 new species of *Simodontus*, but in a manner quite useless to Australian students. Without plainly saying so he seems to assume that the doubt he previously expressed as to the specific distinctness of his *S. æneipennis* and Dejean's *F. australis* was unfounded. Of these 6 species *convexus* is merely compared in brief terms with *australis*, *orthomoides* with *O. berytensis* (a Syrian insect), *transfuga* with *orthomoides*, &c., &c. The Baron subsequently (Ann. Mus. Gen. 1874) expressed the opinion that three of them (he did not specify which) were identical with Sir W. Macleay's three species of *Argutor* from Gayndah.

Finally, in 1888 Sir William Macleay described *S. occidentalis* from King's Sound.

I hardly see any satisfactory way out of this labyrinth, but I think any way is better than remaining in it, until some one is able to examine the types and report on them, which will probably be at the Greek Kalends. Rather than acquiesce in the theory that Australians are to consider themselves barred from giving names to the fauna of their country by the bad descriptions of foreign students, I offer to the Linnean Society, at the risk of eventually proving to have increased the synonymy of some species, descriptions of three *Simodonti* known to me, attributing to existing names two which appear to me likely to be entitled to them, and giving a new name to one which there is not evidence for considering as already satisfactorily named. The species with which I have to deal are all from Southern Australia—one from Mulwala in the south of N.S.W. being the most northern in its habitat; I shall therefore assume that I have none of Sir W. Macleay's species before me, which are all from the north, but unfortunately insufficiently described—the important character of the width of the prothorax at the front as compared with its width at the base (for example) not being alluded to, except in the case of one of them.

SIMODONTUS (HARPALUS) FORTNUMI, Cast.

Latus; sat brevis; nitidus; supra piceus; subtus cum palpis, antennis, pedibusque rufescens vel rufo-testaceus; prothorace quam

longiori dimidia parte latiori, postice quam antice vix latiori, margine antico parum concavo, lateribus sat æqualiter rotundatis, angulis posticis rotundato-obtusis, basi media leviter rotundatim emarginata, striola basali externa vix distincta; elytris basi externa nullo modo dentatis, subtiliter striatis, interstitiis planis, interstitio 3° tripunctulato. [Long. $3\frac{2}{5}$, lat. $1\frac{2}{5}$ lines.

The only species known to me (of the genus) which has the length of the elytra down the suture not at all greater (by measurement) than twice their width across the base. The prothorax scarcely (by measurement the base is $\frac{1}{5}$ again as wide as the front) narrower across the front than across the base is also a good character, nor have I seen any other species having the prothorax as much as half again as wide as long. There is a very distinct transverse strip marked more or less distinctly with longitudinal scratches, and abruptly depressed below the general plane of the surface, running along the base of the prothorax from one to the other of the inner longitudinal foveæ. The external basal fovea on either side close to the hind angle of the prothorax is very feeble and from some points of view seems to be quite non-existent. The large setigerous puncture near the hind angle of the prothorax is (as usual in the genus) very distinct and well within the angle. The concavity of outline on the base of the prothorax is very clearly confined to the middle part of the base. The abbreviated stria close to the scutellum is exceptionally short. The transverse undulations on the prothorax mentioned by Castelnau are variable in intensity but never very noticeable without close examination. The episterna of the metathorax are wider than in the allied species.

Extremely abundant in S. Australia. I have not seen it further west than Yorke's Peninsula.

N.B.—I think there is scarcely any doubt that this insect is identical with *S. curtulus*, Chaud., and also with *S. (Harpalus) brunneus*, Cast. It seems to differ from *S. foveipennis*, Macl., and *S. nitidipennis*, Macl., by its short scutellar stria, from *S. oodiformis* by the feebler striation of its elytra, and from most of the other

described species by its prothorax not narrowed anteriorly. The description of *S. brunneus* is quite useless, giving no information whether the prothorax is narrowed anteriorly and dismissing all the sculpture of the prothorax with the brief expression "impressions moderately strong,"—but as it fits *S. Fortnumi* very well as far as it goes and is founded on specimens from Adelaide I feel no doubt of its identity.

SIMODONTUS AUSTRALIS, Dej.

My collection contains a single example taken at Port Lincoln which agrees very well with Dejean's description of this species. Unfortunately the description is so short that it is easy to suppose there may be other species that will fit it equally well, and as no more precise indication is given of the locality of the type than "New Holland" there is nothing but the description to guide one in selecting an insect to bear the name. However, I claim the name for this S. Australian species by adding to Dejean's diagnosis such particulars as will unmistakably associate the species in question with the name, feeling sure that nothing could *dis*sociate the two unless it might be a reference to the original type. If that can be made and my present memoir should provoke someone to make it and set me right, I shall be very glad.

Minus latus; minus brevis; supra piceo-niger; subtus cum palpis antennis tibiis tarsisque rufescens, femoribus picescentibus; prothorace quam longiori tertia parte latiori, postice quam antice tertia parte latiori, margine antico sat concavo, lateribus leviter sat æqualiter rotundatis, angulis anticis prominulis, posticis rotundato-obtusis, basi rotundatim emarginata, striola basali externa obliterata; elytris basi externa nullo modo dentatis, sat fortiter striatis, interstitiis externis postice angustis convexis, interstitio 3° tripunctulato. [Long. $3\frac{3}{5}$, lat. $1\frac{2}{5}$ lines (vix).

Compared with *S. Fortnumi* this insect is very evidently longer, narrower, and more parallel; the head is smaller in proportion to the other parts; the prothorax is longer and flatter, more concave in front, with the front angles more prominent and less obtuse,

and the dorsal channel continued to the base, it is more narrowed towards the front; the inner longitudinal impression on either side at the base is longer and more sharply defined and the outer one quite or almost obliterated; the concavity of the basal outline is much wider, the sides of the base, moreover, not being at all directed obliquely hindward as well as inward from the basal angles (as they are in *Fortnumi*); the elytra have much stronger striation and the lateral interstices become near the apex linear convex ridges; the abbreviated stria near the scutellum is much longer than in *S. Fortnumi*, reaching almost to the sutural stria. The elytra a little behind the middle are slightly wider than at the base.

Port Lincoln.

SIMODONTUS MURRAYENSIS, sp.nov.

Angustus; piceus; capite prothoraceque obscure rufis (huic nonnullis exemplis marginibus rufo-testaceis), antennis palpis pedibusque rufis; prothorace quam longiori tertia parte latiori, postice quam antice fere tertia parte latiori, margine antico sat concavo, lateribus leviter arcuatis, latitudine majori ante medium posita, angulis anticis prominulis posticis fere rectis, basi late rotundatim emarginata, striola basali externa distincta; elytris basi externa minute dentatis, sat fortiter striatis, interstitiis externis postice sat angustis subconvexis, interstitio 3° tripunctulato.

[Long. $3\frac{1}{5}$, lat. $1\frac{1}{10}$ lines.

This species differs from *S. Fortnumi*, Cast., in most respects in which *S. australis* differs from it; instead however of the external longitudinal impression at the base of the prothorax being obliterated or nearly so that impression is much better defined than in *S. Fortnumi*, and the concavity of outline of the base of the prothorax is almost evenly continuous from one hind angle to the other; the striation of the elytra moreover is not much stronger than in *Fortnumi*, but the lateral interstices are narrower and somewhat convex near the apex (less so however than in *S. australis*), while the elytra instead of being somewhat dilated behind the middle are at their widest very little behind the front whence they narrow continuously (though very slightly and gradually)

hindward. From *S. australis* this species may be known by its still narrower and more parallel form, the well defined outer impression on either side at the base of the prothorax, the continuous concavity of outline all across the base of the prothorax, the somewhat finer striation of the elytra the outer interstices of which are less narrow and convex behind, &c., &c. From both it differs in the distinct though very minute tooth-like prominence of the external apex of the basal keel-like line of the elytra, and its much more nitid surface.

Mulwala, N.S.W.; taken by Mr. T. G. Sloane in refuse from a flood in the Murray.

N.B.—It is possible that this may be identical with *S. elongatus*, Chaud. That species however is described as having an iridescent reflection, and in any case I do not think its name can stand as it has been given by the Baron de Chaudoir himself to two species in other sections of *Feronia*.

MICROFERONIA, gen.nov.

♂. Mentum breve, antice minus fortiter emarginato, dente medio bifido instructo. Palporum articulus ultimus ovalis, apice sat acuminatus; metathoracis episternum (parte apicali pone suturam distinctam inclusa) quam latius fere dimidia parte longius, intra margines anteriorem interioremque sulcatum, margine anteriori quam elytrorum epipleura paullo latiori; segmenta ventralia haud transversim sulcata, segmento apicali punctis setigeris (antice, prope medium utrinque, postice 4 ad marginem apicalem, positis) instructo, segmentis 3 præcedentibus puncto setigero utrinque prope medium instructis; antennæ sat robustæ, articulo 1° sat elongato, ceteris brevioribus, 2° submoniliformi; labrum transversum, antice leviter emarginatum, utrinque tumidum; oculi sat magni, prominuli, sat grosse granulati; elytrorum interstitium tertium unipunctatum; tarsorum anticorum articuli basales 3 sat fortiter dilatati.

♀. Latet.

It should be noted that in this genus (as in many others of the *Feronides)* the bifid tooth of the mentum does not project forward as an uninterrupted continuation, but is a separate piece divided from the mentum by a perfectly distinct suture and is strongly declivous. This structure may readily be observed with an ordinarily strong lens in many of the larger *Feronides (Prionophorus, Notonomus, Sarticus,* &c.). In *Rhytisternus, Simodontus,* and others, the tooth of the mentum is more a continuation of the general plane of the surface. In small species where the tooth of the mentum is strongly declivous it is extremely difficult to see. In the present insect, although it is quite distinct under a compound microscope, I cannot obtain a satisfactory sight of it with a Coddington lens.

The labrum, too, is very peculiar, the lateral portion on either side being strongly tumid, so that the middle portion appears to be a sulcus. Another noteworthy character consists in the two large strong punctures placed in the front part of the apical ventral segment,—one on either side of, and close to, the middle line. The palpi, too, having their apical joint unusually long and dilated, are peculiar. The basal 3 joints of the antennæ are glabrous, the 4th belonging to the pubescent series.

The small insect for which I propose this name has the facies of *Loxandrus.* It also somewhat resembles *Notophilus (Anisodactylidæ),* from which the glabrous 3rd joint of the antennæ will at once distinguish it.

MICROFERONIA ADELAIDÆ, sp.nov.

Ovalis; sat convexa; nitida; piceo-nigra, supra iridescens; labro, mandibulis, antennis (his apicem versus vix infuscatis), palpis, pedibus, et elytrorum sutura margineque laterali, testaceis; prothorace leviter transverso, antice quam postice paullo angustiori, canaliculato, latitudine majori ante medium posita, margine antico subtruncato, lateribus leviter rotundatis postice haud sinuatis, angulis posticis subrotundatis, sulco longitudinali elongato

utrinque ad basin posito; elytris fortius striatis, striis lævibus, interstitiis planis, stria abbreviata scutellari foveiformi, basali. [Long 2 (vix), lat. $\frac{4}{5}$ line.

Near Adelaide; a single example.

ANCHOMENIDES.

LESTIGNATHUS MINOR, sp.nov.

Sat elongatus; sat robustus; niger vix viridi-æneus; antennis (articulis basalibus 3 plus minus piceis exceptis), palpis, tarsisque rufescentibus; pedibus piceis; capite sat angusto, oculis magnis prominulis; prothorace quam longiori dimidia fere parte latiori, antice quam postice sat angustiori, pone marginem anticum breviter profunde transversim impresso, sat fortiter canaliculato, lateribus ab angulis anticis (his obtuse productis) ad basin gradatim magis fortiter explanatis, angulis posticis rotundatis; elytris quam prothorax vix duplo latioribus, fortiter striatis, striis lævibus, interstitiis (præsertim postice) convexis. [Long. 5, lat. $2\frac{1}{5}$ lines.

This species has something of the facies of *Agonum*.

Port Lincoln; a single example was found running in the sunshine on sandhills behind the beach.

PLATYNUS MARGINELLUS, Er.

I have in my collection a series of specimens from various localities which tally perfectly with Erichson's description, but if I am right in my identification (of which I feel no doubt) that description omits a very distinctive character,—viz., that the 3rd stria on the elytra is conspicuously deepened from near its base to about the middle, the 5th stria also presenting a similar structure less conspicuously near the apex. Specimens from Western Australia appear to be a little more robust in build, with slightly stouter antennæ, these latter and the legs being of a paler colour than in average examples taken near Adelaide, but there seems no reason to consider them as specifically distinct. I suspect that *Anchomenus*

nigro-æneus, Newm., is the same insect. The only noteworthy differences between the two descriptions are that Newman does not mention the reddish pitchy colour of the extreme margin of the elytra (which is scarcely noticeable in some examples before me) and that he calls the striæ of the elytra "haud puncta," while Erichson says "striis omnium subtilissime punctulatis."

Platynus Murrayensis, sp.nov.

Elongatus; parallelus; testaceo-brunneus, pedibus dilutioribus; prothorace capite parum latiori, quam longiori vix latiori, subtiliter canaliculato, basi margini antico latitudine æquali, lateribus leviter arcuatis, latitudine majori mox ante medium posita, angulis, posticis obtusis; elytris subtiliter striatis, striis vix perspicue punctulatis, stria 3^a ante medium manifeste profundiori.

[Long. $4\frac{2}{5}$, lat. $1\frac{2}{5}$ lines.

The width of the prothorax scarcely exceeds that of the head across the eyes; the elytra are unusually narrow in proportion to the prothorax (as 14 to 9); the prothorax is scarcely $\frac{1}{6}$ wider than long. This species bears some superficial resemblance to the European *Anchomenus livens*, Gyll., but is considerably narrower and more elongate. It is at once distinguished from *P. marginellus*, Er., by its much more elongate form and prothorax scarcely wider than long, as well as by its colour, and the less noticeable deepening of the 3rd stria of the elytra.

Murray Bridge, S.A.; on swampy ground.

HYDROPHILIDÆ.

Hydrobiomorpha Helenæ, sp.nov.

Sat convexa; sat late ovalis; nitida; subtus dense breviter pubescens, piceo-rufa; supra crebre minus subtiliter punctulata, olivaceo-nigra; elytris vittis 6 viridibus notatis; labri et clypei parte anteriori, palpis (apice summo nigro excepto), antennis (articulis ultimis 3 piceis exceptis) et pedibus, rufo-testaceis;

prothoracis angulis posticis vix rufescentibus; capite prothorace et elytris punctis majoribus seriatim (ut *H. Tepperi* dispositis) instructis, his capillos subtiles ferentibus; mesosterni carina antice haud abrupte declivi. [Long. 6-7, lat. 3-3½ lines.

Maris palporum maxillarium articulo 3° valde dilatato.

Of the elytral stripes (which are of a dull pale green colour) the first is close to the suture, the next 4 coincide with the rows of larger punctures, the last is very near to the lateral margin. Apart from colour this species differs from *Tepperi* as follows,—it is a broader insect with less parallel sides, the surface is a little more conspicuously punctulate, the hind angles of the prothorax are less rounded off, the penultimate joint of the maxillary palpi in the male is very much more strongly dilated, and the mesosternal carina is much less abruptly declivous in front. This latter character, *inter alia*, will distinguish the species from *H. Bovilli.*

I observe in the three species of this genus a character that had escaped my attention when I described the generic characters;—the mesosternal keel is nicked by a little emargination close to its anterior declivity, and this makes the extreme front appear as a small conical tubercle.

I have dedicated this insect to Mrs. Bovill, who has recently given me three specimens of it from the N. Territory of S. Australia, and whose explorations in that interesting region have brought to light not a few new species.

LONGICORNES.

MICROTRAGUS ASSIMILIS, sp.nov.

Dense pallide sqamulosus, palpis testaceis, mandibulis nigris; prothorace (spinis lateralibus exclusis) quam latiori paullo longiori, antice quam postice vix angustiori, supra fortiter depresso, utrinque spina robusta conica instructo, supra leviter (ad latera crassissime) punctulato, lateribus leviter arcuatis; scutello valde

transverso, transversim concavo; elytris prothorace (spinis lateralibus inclusis) sat latioribus, carinis 2 (discoidali integra, externa serrata) instructis, illa anticespinam robustam extrorsum inclinatam formanti, parte dimidia discoidali antica sparsim subtiliter (postica vix perspicue) punctulata, parte declivi laterali antice granulata postice sparsim subtiliter punctulata, apice singulatim oblique truncato explanato. [Long. 11, lat. 4 lines.

The entire surface, including the underside, antennæ and legs is covered with even, very close, adpressed scale-like pubescence of a pale drab colour, slightly darker on the sides of the prothorax, and is devoid of erect hairs save a few fine and inconspicuous ones on the prothorax and antennæ; the large coarse punctures on the declivous sides of the prothorax, however, each contain a small granule not rising above the surface and concolorous with it; the granules on the front part of the sides of the elytra are black and shining. A broad space down the middle of the prothorax is devoid of punctures. The spine at the base of each discoidal carina is very little raised above the surface, its projection being almost wholly lateral. The discoidal carinæ are pitted on their sides posteriorly with a few large punctures which give them a serrated appearance when viewed from above, but their upper outline viewed from the side is seen to be almost entire, a little waviness being noticeable in the hinder part. The apex of each elytron is explanate and obliquely truncate, the external end of the truncation joining the lateral margin in a somewhat angular manner.

Allied to *M. Waterhousei*, Pasc., and *M. Mormon*, Pasc. It differs, *inter alia*, from the former by the absence of hairs from the body, and by the discoidal carina not being a row of tubercles,—from the latter by the absence of hairs and by the differently formed apex of the elytra.

Fowler's Bay.

MICROTRAGUS ALBIDUS, sp.nov.

Dense squamosus, squamis fuscis griseis et albidis confuse intermixtis, palpis testaceis, mandibulis nigris; setulis erectis

brevibus nigris (nisi sub lente vix perspicuis) sparsim vestitus; capite pedibusque certo adspectu totis albis; prothoracis spinis lateralibus et disco antice, utrinque albis; antennis fuscis, articulis singulis basi albis; prothorace (spinis lateralibus exclusis) quam longiori parum latiori, antice quam postice paullo angustiori, supra parum depresso, utrinque spina brevi conica instructo, supra fortiter subcrebre (ad latera crassissime) punctulato, lateribus leviter arcuatis; scutello haud transverso, apice subacuminato: elytris prothorace (spinis lateralibus inclusis) vix latioribus carinis 2 serratis instructis, carina discoidali antice processum magnum obtusum suberectum formanti; parte dimidia discoidali antica subtiliter sat crebre (postica vix perspicue) punctulata; partibus tertiis anticis 2 declivibus lateralibus, sat crebre granulatis; apice singulatim suboblique truncato vix explanato. [Long. 10, lat $3\frac{1}{2}$ lines (vix).

Differs from *M. Waterhousei*, Pasc., *inter alia* by the longitudinal line on the head running very conspicuously the whole length from the clypeus to far behind the level of the eyes, by the length of the scutellum equal to the width of the same, by the truncate apices of the elytra, by the shape of the elytral carinæ—which are continuous, though their outline (from any point of view) appears serrated—by the form of the process at the base of the inner carina, which closely resembles the pommel of a lady's saddle—being compressed, with a roundly truncate apex.

Differs from *M. Mormon*, Pasc., and from *M. assimilis* in many respects, and especially in the totally different scutellum.

When closely examined this species appears to be rather closely sprinkled all over with minute snowy-white spots, such spots consisting of single white scales interspersed with the darker ones.

W. Australia; sent to me by Mr. T. G. Sloane.

MICROTRAGUS MACULATUS, sp.nov.

Dense pubescens; pube in corpore subtus in capite in antennis in pedibus et in prothoracis elytrorumque lateribus grisea, in pro

thorace supra et in elytrorum maculis nonnullis nigra, in prothoracis maculis nonnullis et in elytrorum partibus discoidalibus (maculis nigris exceptis) fulva; prothorace (spinis lateralibus exclusis) quam latiori paullo longiori, antice quam postice haud angustiori, supra sat convexo, utrinque spina magna robusta conica instructo, rugulose crassissime punctulato, lateribus minus fortiter arcuatis; scutello parvo elongato-triangulari; elytris prothorace (spinis lateralibus inclusis) vix latioribus, supra sat leviter (latera versus grosse) sparsim punctulatis, carinis 2 simplicibus instructis (exteriori antice obsoleta, altera antice spinam robustam obtusam suberectam formanti), apice minute divaricatis; corpore toto, antennis, pedibusque, setis plus minus squamiformibus (alteris albidis alteris nigris) vestitis. [Long. $7\frac{1}{2}$, lat. $2\frac{1}{2}$ lines.

The antennæ (by measurement) are slightly more than $\frac{2}{3}$ the length of the whole insect. The spots of fulvous pubescence on the prothorax are not very conspicuous,—one occupies the centre of the disc, another (smaller) is on either side a little in front of the middle. The black spots on the elytra are extremely conspicuous and are arranged as follows;—about 9 small spots down each side of the suture (the last 3 or 4 more or less confluent on each row),—the basal tubercle and about 4 spots (the 2nd and 3rd largest) on the discoidal carina,—a very large spot of irregular form extending from near the lateral margin to near the discoidal carina and longitudinally from the apex of the basal $\frac{1}{5}$ of the elytron to the middle,—two or three spots on the defined part of the external carina; all the punctures on the elytra also more or less black.

Near *M. Arachne*, Pasc., and *sticticus*, Pasc. From the former it differs *inter alia* in colour (*e g.* head pale grey instead of dark brown), also in having the external elytral carina scarcely traceable except in its hinder half instead of "entire and well marked;" from the latter in having the pubescence of the black spots (apart from colour) quite similar to that of the rest of the surface instead of "composed of stiff erect hairs * * * raised above the surrounding pubescence." The discoidal carina is bent round towards

the suture at its apex, but does not reach the latter. Probably the black spots are subject to more or less variety.

Barrow's Creek, N. Territory of S. Australia; taken by Mr. W. D. Randall.

ATHEMISTUS BITUBERCULATUS, Pasc.

I have before me specimens—one at least of them from Gippsland, Vict., (taken by Mr. T. G. Sloane)—which agree with the description of this species in every respect except the punctuation of the head, which in all of them is very distinct though sparse and rather fine. Mr. Pascoe says, "head almost impunctate except on the vertex." I can hardly think the insect distinct from that Mr. Pascoe described.

MOLLUSCA TRAWLED OFF MERIMBULA, NEW SOUTH WALES.

By J. Brazier, F.L.S., &c.

The Australian Museum received last month from Mr. F. W. Smithers, Inspector of N.S.W. Fisheries, a small collection of shells trawled by him off Merimbula in 17 fathoms. The only species of special interest is the *Crassatella Kingicola*, Lamk., now for the first time recorded from the New South Wales coast.

Other things might have been obtained if some practical scientists had been sent on behalf of the Museum to look after what came to the surface, instead of its being discarded and thrown back into the sea as rubbish, as is very often done by those who do not know what they are doing. Appended is a list of the species obtained.

1. Cassis pyrum, Lamk.

Cassis pyrum, Lamarck, Anim. s. Vert. Vol. VII. part 1, p. 226; Kiener, Coq. Viv. p. 39, pl. 13, fig. 25, pl. 15, fig. 30; Reeve, Conch. Icon. Vol. V. pl. 11, fig. 29 b; Conch. Cab. 2nd ed. Kuster, p. 29, pl. 47, figs. 5-6.

The only specimen measures 2½ inches long, and was the home of an hermit crab, *Clibanarius strigimanus*, White.

2. Myochama anomioides, Stutchbury.

Myochama anomioides, Stutchbury, Zool. Journal, Vol. V. p. 97, Tab. Supp. 42, figs. 1, 2, 3, 4; *Myochama anomioides*, Hancock,

Ann. Mag. Nat. Hist. Vol. XI. p. 287, pl. 11. (Animal), 1853; *Myochama anomioides*, Woodward, Manual, pl. 23, fig. 13; *Myochama anomioides*, Reeve, Conch. Icon. Vol. XII. pl. 1, fig. 4c, 1860; *Myochama Keppelliana*, A. Adams, Proc. Zool. Soc. p. 90, pl. 15, fig. 1, 1852; *Myochama Stutchburyi*, A. Adams, Proc. Zool. Soc. p. 90, pl. 15, fig. 4, 1852; *Myochama Keppelliana*, Reeve, Conch. Icon. Vol. XII. pl. 1, fig. 2, 1860; *Myochama anomioides*, Chenu, Manuel Conch. Part 2, p. 52, fig. 219; *Myochama Stutchburyi*, Chenu, fig. 218; *Myochama Keppelliana*, Chenu, fig. 220, 1862; *Myochama anomioides*, Fisher, Manuel de Conch. p. 1159, pl. 23, f. 13.

One living specimen attached to the posterior end of *Crassatella Kingicola*, Lamk. The so-called *Myochama transversa*, A. Adams, and *Myochama tabida*, Reeve, are merely local varieties of *M. anomioides*, Stutchbury, found in and around Moreton Bay and Port Curtis, Queensland. *Myochama anomioides* and varieties I have found on *Venus (Antigona) lamellaris*, Schumacher; *Circe scripta*, Linné; *Circe rivularis*, Born; *Chione roborata*, Hanley; *Trigonia Lamarcki*, Gray; *Pectunculus Grayanus*, Dunker; *Pectunculus holoserica*, Reeve; *Corbula Smithiana*, Brazier; *Mitra solida*, Reeve; *Cardita amabilis*, Deshayes; *Crassatella Cumingi*, A. Ad.; in Port Jackson and Moreton Bay.

3. VENUS (CHIONE) ROBORATA, Hanley.

Venus roborata, Hanley, Proc. Zool. Soc. p. 161, 1844, Recent Shells, App. p. 361, pl. 16, f. 25; Reeve, Conch. Icon. Vol. XIV. pl. 23, fig. 183; Sowerby, Thes. Conch. Vol. II. p. 723, pl. 157 fig. 117-118.

The single example is not of that ivory-white colour like the type from Tasmania, but of a chocolate-brown, and thinner with the ribs very slightly reflected.

4. Venus (Timoclea) gallinula, Lamarck.

Venus gallinula, Lamk. Anim. s. Vert. Vol. V. p. 592, No. 25; Sowerby, Thes. Conch. Vol. II. p. 730, pl. 162, fig. 225-226.

One single specimen obtained ornamented with three dark brown rays on each valve, concentrically fimbriately ribbed, finely radiately ridged on the posterior side; interior of the valves dark violet.

5. Cytherea (Callista) rutila, Sowerby.

Cytherea rutila, Sowerby, Thes. Conch. Vol. II. p. 743, pl. 163; *Dione rutila*, Reeve, Conch. Icon. Vol. XIV. pl. 5, fig. 18; *Dione rutila*, Deshayes, Catalogue Conch. of British Mus. p. 58.

One specimen was obtained. The brown rays are not interrupted as is generally the case with this species when fresh from the sea. It is one of the most handsome species found on the coast, being entirely of a splendid bright pink with the brown rays and zones showing out in bold relief; after a few days they begin to fade, and the bright pink only shows round the margins.

6. Crassatella Kingicola, Lamarck.

Crassatella Kingicola, Lamarck, Anim. s. Vert. Vol. V. p. 481, No. 1; *Crassatella Kingicola*, Reeve, Conch. Icon. Vol. I. pl. 1, fig 5.

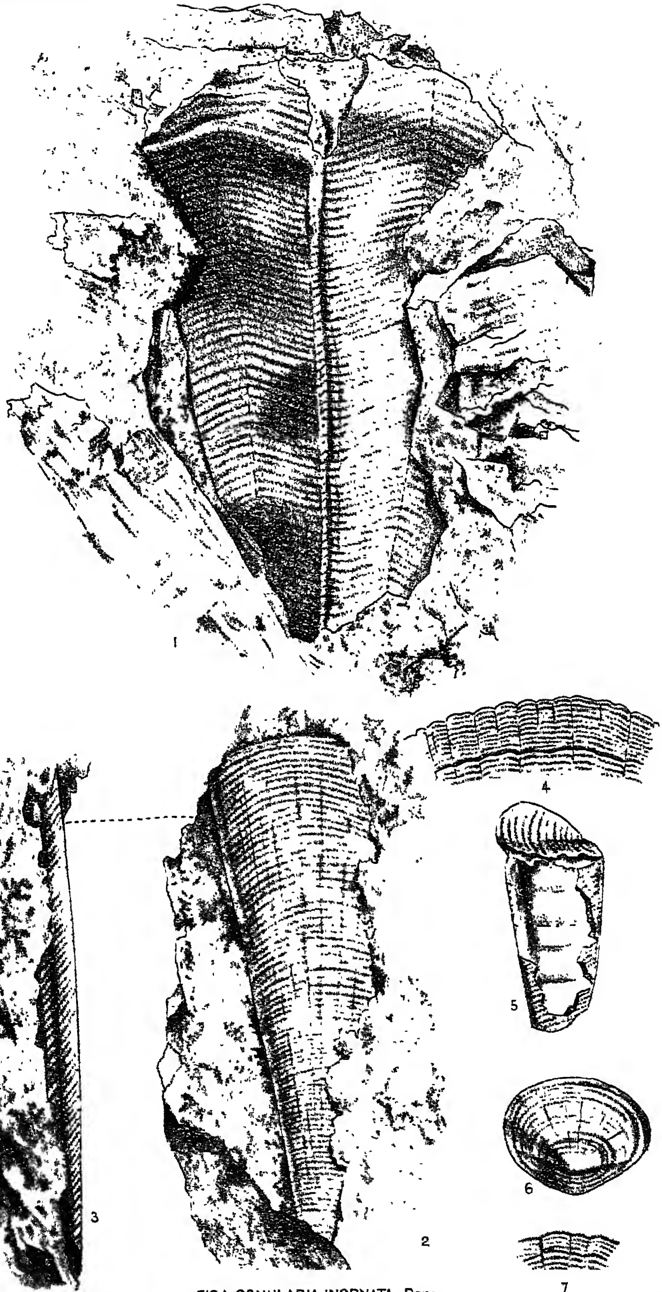
Two specimens obtained differ very much; one is ovately orbicular, slightly depressed, the umbones strongly plaited, of a rose tinge-colour; anterior side rounded, posterior side rather long angulated: the second one partakes of the character of *Crassatella castanea*, Reeve, the anterior side rounded; posterior angular and abrupt. I believe that seven of the so-called species of *Crassatella* from Australia are one and the same species, and are not even to be called varieties, viz.:—*Crassatella Kingicola*, Lamarck; *C. donacina*, Lamarck; *C. castanea*, Reeve; *C. decipiens*, Reeve; *C. errones*, Reeve; *C. pulchra*, Reeve; and *C. Cumingi*, A. Adams.

During the S.E. gale of May this year, Mr. E. Richards found washed up on the beach two miles north of Ballina, Richmond River, two specimens of a *Crassatella* which are evidently the young of Reeves' *C. pulchra* = *C. Kingicola*, Lamarck.

7. Pectunculus Grayanus, Dunker.

Pectunculus Grayanus, Dunker, Proc. Zool. Soc. p. 357, 1856.

Sixteen specimens were obtained. A thick orbicular shell, mostly white with angular streaks and flames of chestnut-brown colour; it is a very variable species a number of specimens having a fringe of velvety epidermis round the margins.



P.T. Hammond, del ad nat

FIG 1 CONULARIA INORNATA, Dana.
FIG. 2-7. HYOLITHES LANCEOLATUS, Morris, sp

Baron & Gatward, lith

ON THE FURTHER STRUCTURE OF *CONULARIA INORNATA*, DANA, AND *HYOLITHES LANCEOLATUS*, MORRIS, SP., (=*THECA LANCEOLATA*, MORRIS).

By R. Etheridge, Junr.

Palæontologist to the Australian Museum and Geological Survey of N.S.W.

1. Conularia inornata.

(Plate xx., fig. 1).

Conularia inornata was originally described * by Prof. J. D. Dana from a fragmentary specimen obtained during the visit of the United States Exploring Expedition under Commodore Wilkes, U.S.N., to these shores. A few years ago more perfect examples, upwards of one foot in length, were described † by the late Prof. L. G. de Koninck, in the collection of the late Rev. W. B. Clarke, F.R.S. So far, however, the structure of the proximal end of the shell is unknown.

In 1873 the writer had the good fortune to figure the most perfect example of *Conularia* yet discovered, ‡ from the Carboniferous Limestone of the East of Scotland, in which the sides of the shell were inflected inwards, on all four sides, at a regular and similar angle, and to a like extent, each flap separated as it were by a deep groove from its neighbour, and the whole leaving

* U.S. Exploring Expedition, 1838-1842, under Charles Wilkes. U.S.N. Vol. X. Geology, by J. D. Dana, 1849, p. 709.

† Foss. Pal. Nouv. Galles du Sud, Pt. 3, 1873, p. 314, t. 22, f. 14.

‡ Geol. Mag. 1873, X. p. 295.

a quadrangular aperture at the summit of the proximal end. A forecast of this structure had been previously figured * by James Sowerby, the summit of whose specimen had the edges of the broader or truncated end of the cone turned inwards; but this seems to have been regarded by Sowerby and subsequent writers, to judge from the manner in which it has been overlooked, merely as a lateral crushing and displacement of the test. Two of the Upper Silurian *Conulariæ* † figured by the late M. Barrande likewise show traces of this peculiarity, viz., *C. plicosa*, Barr., and *C. anomala*, Barr.

Mr. J. Waterhouse, M.A., Inspector of Schools, Dungog, lately forwarded to the Mining and Geological Museum, Department of Mines, some calcareous spherical nodules of grey micaceous very hard mudstone, which he had obtained from a sandy shale in the sinking of the East Maitland Coal Co.'s shaft near Farley, in the Upper Marine Series, at a depth from the surface of about sixty feet. These nodules proved to be very fossiliferous, containing in some instances a number of *Conularia inornata*, almost invariably associated with fossil wood. None of the *Conulariæ* are absolutely perfect, but several are of great interest from the fact that the sides of the cone at the broader or proximal end are bent inwards, foreshadowing the structure of the Scotch specimen previously referred to.

In some the evidences of crushing by the surrounding matrix are apparent by the displacement and distortion of the transverse ornamenting ridges, but in other cases the bending inwards is so gradual, and the regularity of the other features so maintained, that a closure of the proximal end may, I think, fairly be anticipated in *Conularia inornata.* Although there are too many traces of pressure to warrant us in wholly ascribing this appearance to natural form, the attention of collectors should be drawn to it from the large size assumed, and important position occupied,

* Mineral Conchology, iii. p. 107, t. 260, f. 4.

† Syst. Sil. Centre Bohême, 1867, iii. t. 6, f. 1, and t. 8, f. 15.

by *Conularia* in the marine beds of the N. S. Wales Permo-Carboniferous System. Many points in the life history of *Conularia* yet remain to be solved, such as its proper place in the zoological scale, perfect condition of the shell, and other details. The constant association of wood with the mollusc in these nodules is, to say the least of it, peculiar.

2. Hyolithes lanceolatus.

(Plate xx., figs. 2-7).

One of the few known Carboniferous species of J. D. C. Sowerby's genus *Theca* was described by the late Prof. John Morris in Strzelecki's work * as *Theca lanceolata*, from Illawarra, and it also happens that this was likewise the first enunciation of the genus. It was pointed out, however, by the late M. Barrande † that Eichwald's genus *Hyolithes*, proposed for similar supposed lanceolate-shaped shells, was published five years before the appearance of Strzelecki's work. This is unfortunate, as Sowerby and Morris's genus had become well-known and established amongst geologists; but as the strict law of priority necessitates the adoption of Eichwald's name, our Australian fossil must in future be known as *Hyolithes lanceolatus*, Morris, sp. This is much to be regretted, for Morris's description is far more comprehensive and fuller than Eichwald's.

The Mining and Geological Museum is again indebted to Mr. John Waterhouse for some excellently preserved specimens of this shell with the operculum *in situ*. The first observer to make known the presence of an operculum in *Theca*, so far as I am aware, was the late Mr. J. W. Salter,‡ but this part of the economy was afterwards copiously illustrated by Barrande. Salter remarked that the shell described by him as *Theca operculata*, had "constantly associated with it, and often in juxta-

* Phys. Descrip. N. S. Wales, &c., 1845, p. 289, t. 18, f. 8.

† *Loc cit.* p. 55.

‡ Mem. Geol. Survey Gt. Britain, iii. 2nd Edit. 1881, p. 558.

position, a shelly plate which would just fit the aperture." In thus possessing an operculum *Hyolithes* departs from the structure of the straight or slightly curved Pteropods, in which opercula are rare, and approaches the spirally-rolled forms, many of which are furnished with one, and it therefore occupies a very marked position in the Thecosomate division of the Pteropoda. For this *Theca*-like shell with an operculum Salter adopted the sub-generic name of *Cleidotheca.*

The description of *Hyolithes lanceolatus* by Morris is as follows :—"Shell elongate, gradually tapering; section obtusely trigonal; surface marked with numerous transverse striæ, which become arched as they pass over the posterior (?) portion of the shell."

The general form of the shell in *Hyolithes* is elongately pyramidal, usually curved, but occasionally straight. The curvature occurs in one of two directions—either in the plane of the broader faces or laterally. The transverse section is triangular—either rectilinear or curvilinear. The faces of the pyramid are usually plain, but at times marked by longitudinal ridges. The aperture is generally oblique to the longer axis, and in some a segment of a circle, often semicircular. The sides, or lesser faces, are acute or rounded; whilst the summit of the shell is always acute, and in some species, according to Barrande, septate.

Hyolithes lanceolatus conforms generally to the generic characters. In its specific features it may be said to be elongately pyramidal and much compressed. It is but little arched longitudinally, in fact the shell is almost in one plane; transversely it is equally little arched, the section being slightly trigonal or unequally oval, the lateral faces being obtusely rounded. The perfect apex of the shell has not come under my notice, nor have I seen any trace of septation. The test is highly ornate, being covered with obtuse concentric rugæ parallel to the sectional outline, separated by very shallow interspaces of about their own width apart, both being again traversed by delicate continuous striæ following the same direction. The whole of this trans-

versely arranged ornament is broken up into a festoon-like appearance by delicate longitudinal, inequidistant grooves. The former is directed convexly upwards towards the aperture on the chief face of the shell, sigmoidally curved on the sides and horizontal on the lesser of the principal faces.

The most interesting point, however, is the operculum. This organ in *Hyolithes* consists of two essential parts—a chief semi-conical portion, the semicircular base of which is applied to the margin of the larger face; and a smaller portion separated from the former by two rather deep grooves radiating from an umbo, and always inclined more or less at an angle to the major portion. The operculum of *H. lanceolatus*, of which we possess an excellent example separated from the shell, and another attached *in situ*, is ornamented in a similar manner to the shell, but the festoon shaped striæ become concentric in the strict sense of the word, and are uninterrupted by regular radiating grooves, although from the umbo to the convex margin of the larger half proceed two or three indefinite radiating wrinkles. On the surface of the smaller concave portion of the operculum are two additional diverging grooves from the umbo, separating off, with the assistance of those formerly mentioned, two elongately triangular spaces. The concentric lines on the smaller portion are much coarser than on the conical or convex half. On the whole this operculum has much the appearance of some *Chiton* plates.

The specimens are taken to be *Hyolithes lanceolatus*, although the transverse section of the shell is not so trigonal as that represented in Morris's figure; neither have I seen any trace on the internal cast of the obtuse ridges described by that author. The largest measures nearly one and a-half inches in length, somewhat less than the type, and the operculum is five-sixteenths of an inch in its longest diameter.

The present examples were obtained by Mr. Waterhouse at the new shaft of the Maitland Coal Company, between the West Maitland and Farley Railway Stations on the Northern line; and at Silkstone, near Tumbleby, in very hard but similar nodules to the *Conulariæ*, and from a like horizon.

This species is an important one from the fact that it is one of the few Carboniferous forms of its genus. According to Barrande,* *Hyolithes* does not occur in the Carboniferous, but jumps from the Devonian, to which he referred the present species, to the Permian. The latter formation contains one species, described by Dr. H. B. Geinitz, but it is needless to observe that there are no grounds for placing *H. lanceolatus* in the Devonian. Prof. K. Zittel, on the contrary, mentions † one Carboniferous species, which is probably the present form.

EXPLANATION OF PLATE.

Fig. 1.—*Conularia inornata*, Dana. Portion of a large specimen with the sides of the shell at the upper or proximal end inwardly bent towards the centre. (Nat. size.)

Fig. 2.—*Hyolithes lanceolatus*, Morris, sp. An almost complete shell viewed from the convex face. (×2.)

Fig. 3.—Side view of the same specimen. (×2.)

Fig. 4.—Portion of the external sculpture of the same, highly magnified.

Fig. 5.—Another example, partially decorticated, with the operculum *in situ*. (×2.)

Fig. 6.—An isolated operculum seen from above. (×2.)

Fig. 7.—External sculpture of the same, highly magnified.

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* *Loc cit.* p. 73.

† Handbuch der Palaeontologie, 1885, 1 Abth. ii. Bd. p. 316.

DIPTERA OF AUSTRALIA.

By Frederick A. A. Skuse.

Part VII.—THE TIPULIDÆ BREVIPALPI.

(Plates xxi-xxiv.)

The Tipulidæ or Crane-flies constitute a very extensive family, usually characterized by the great length and fragility of their legs, the absence of ocelli, a peculiar structure of the ovipositor, elongated basal cells to the wings, and the presence of a discal cell; but always to be distinguished from every other family in the division by the V-shaped transverse suture on the thorax.

This family is classified under two main divisions, the Tipulidæ brevipalpi and longipalpi, and two very small intermediate groups. In the first division the terminal joint of the palpi is little if anything longer than the two preceding joints, whilst in the second it is much longer and flagelliform. This peculiarity of the last joint of the palpi is in each division supported by numerous important subsidiary characters, a detailed account of which may be found in the works of Baron Osten-Sacken.

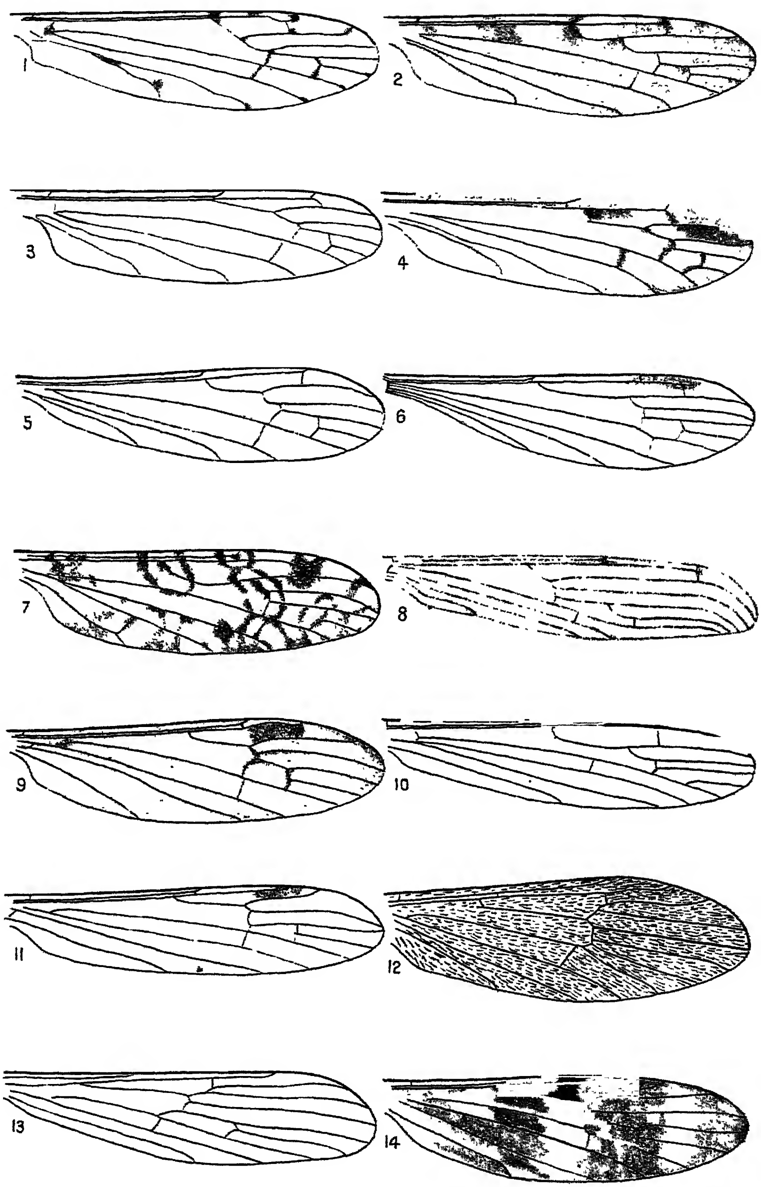
No Australian representatives of the two small intermediate groups, Cylindrotomina and Ptychopterina, have yet been found; the Tipulidæ longipalpi are however well represented, and will form the subject of a future paper.

The present instalment can be only a preliminary contribution to the knowledge of the Australian species of Tipulidæ brevipalpi; indeed, as can be readily seen, the bulk of the species hereafter treated of are known simply as being denizens of Sydney, the Blue Mountains, and the few other adjacent localities which have received anything approaching special collecting. Beyond

New South Wales the country has not been searched for Tipulidæ; only incidental or conspicuous specimens have been obtained by collectors whose pursuits were more particularly otherwise directed. There is most probably a wealth of material yet to be gathered, but unfortunately the investigators are limited.

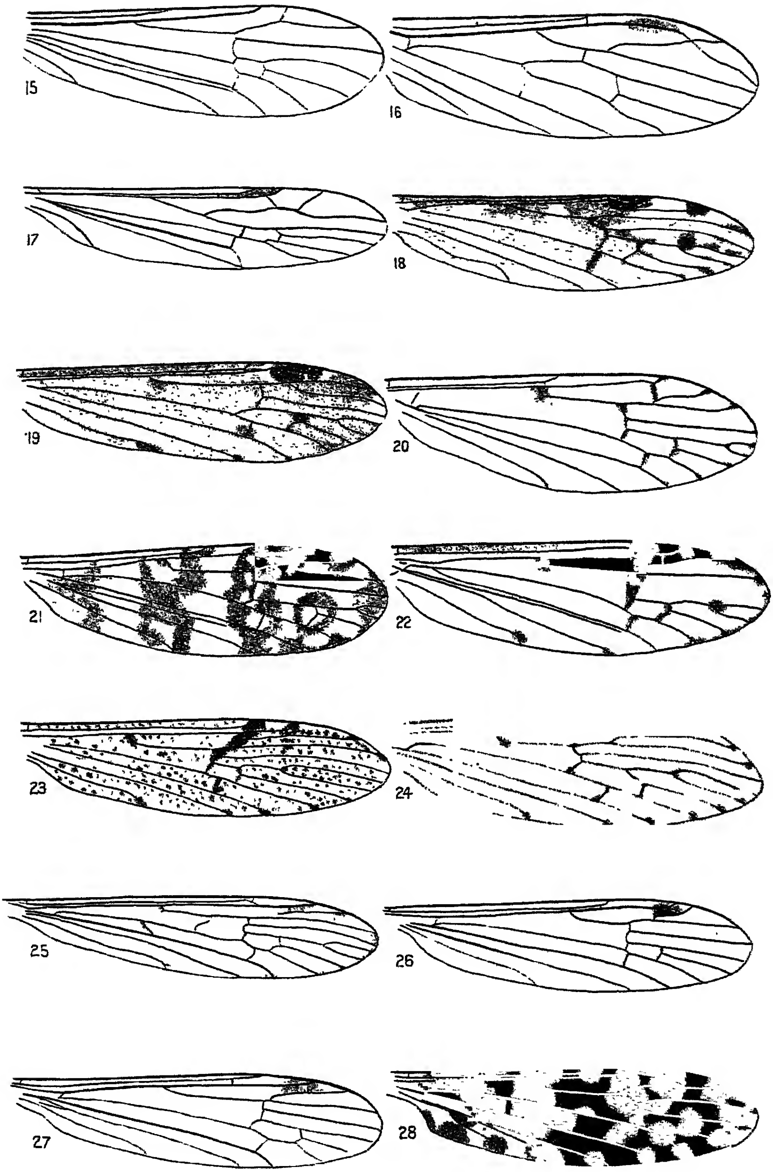
The number of species referable to this division of the Tipulidæ, with which Australia has hitherto been credited, altogether does not exceed twenty-three. From this total four names must be sunk as synonyms, whilst a fifth, *Gynoplistia constans*, Saund., of Walker's list, seems to be that of an undescribed insect; the number being thus reduced to eighteen. This, however, must be supplemented by the names of three characterized species, viz.:—(1) *Gynoplistia annulata*, Westw., erroneously described as a native of North America, (2) *Libnotes strigivena*, Walk., originally found in New Guinea, and (3) *Conosia irrorata*, Wied., from Java, now recorded from Australia for the first time. To the final total of twenty-one species known to occur in this country, descriptions of about eighty new ones are added in the following pages.

It has been found necessary to introduce five new genera; one each in the sections LIMNOBINA and LIMNOBINA ANOMALA, and three in ERIOPTERINA. Though feeling very reluctant to propose new genera there seems to be no alternative in each case where it has been done. Besides these fresh genera, the genus *Geranomyia* has been split up into three sub-genera for the reception of species found to possess two-, three-, and four-jointed palpi respectively; also, a sub-genus of *Rhypholophus* is characterized. The entirety of the species are distributed as follows:—LIMNOBINA [genera *Dicranomyia* 14, *Thrypticomyia* (gen.nov.) 1, *Geranomyia* 4, *Limnobia* 1, *Trochobola* 1, and *Libnotes* 1]; LIMNOBINA ANOMALA [*Rhamphidia* 4, *Orimarga* 2, *Leiponeura* (gen.nov.) 2, and *Teucholabis* 1]; ERIOPTERINA [*Rhypholophus* 2, *Molophilus* 16, *Tasiocera* (gen.nov.) 2, *Erioptera* 1, *Trimicra* 2, *Gnophomyia* 1, *Goniomyia* 1, *Rhabdomastix* (gen.nov.) 1, *Lechria* (gen.nov.) 1, *Trentepohlia* 1, and *Conosia* 1]; LIMNOPHILINA [*Limnophila* 16, *Gynoplistia* 18, and *Cerozodia* 1]; and lastly AMALOPINA [genus *Ama-*



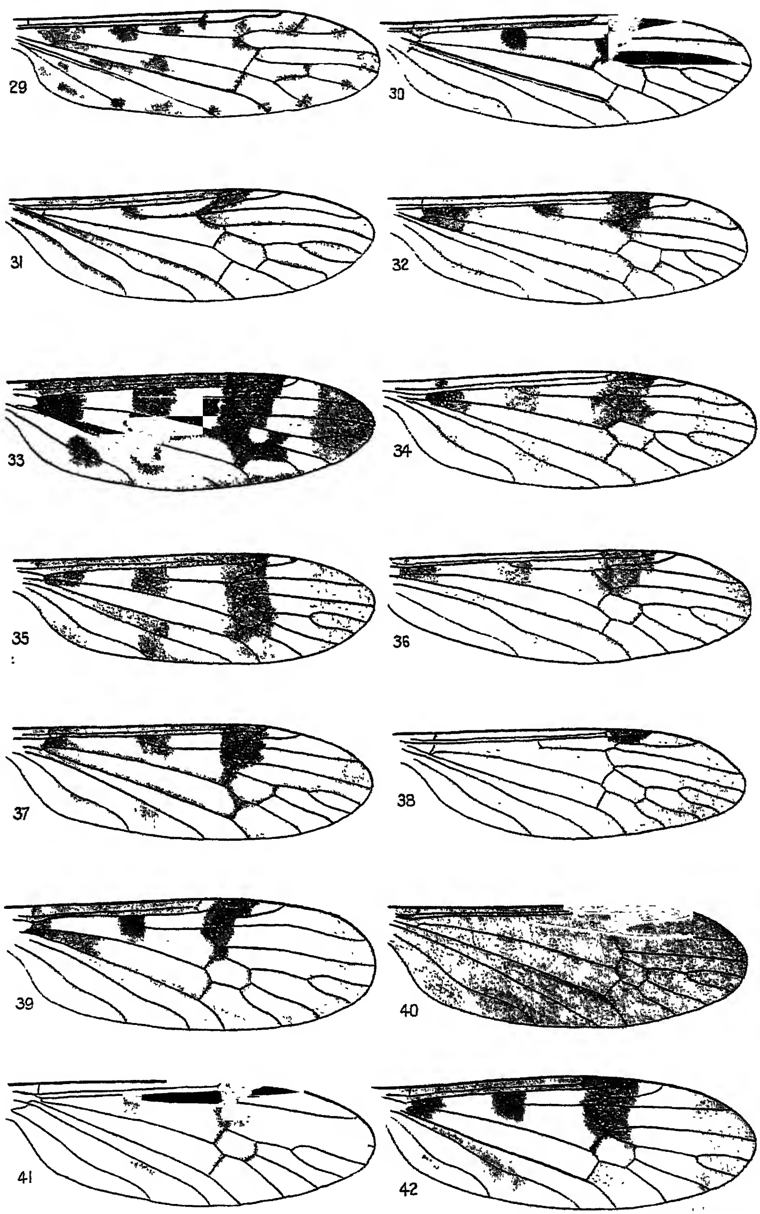
F.A.A. Skuse del.

Baron & Galward, lith.



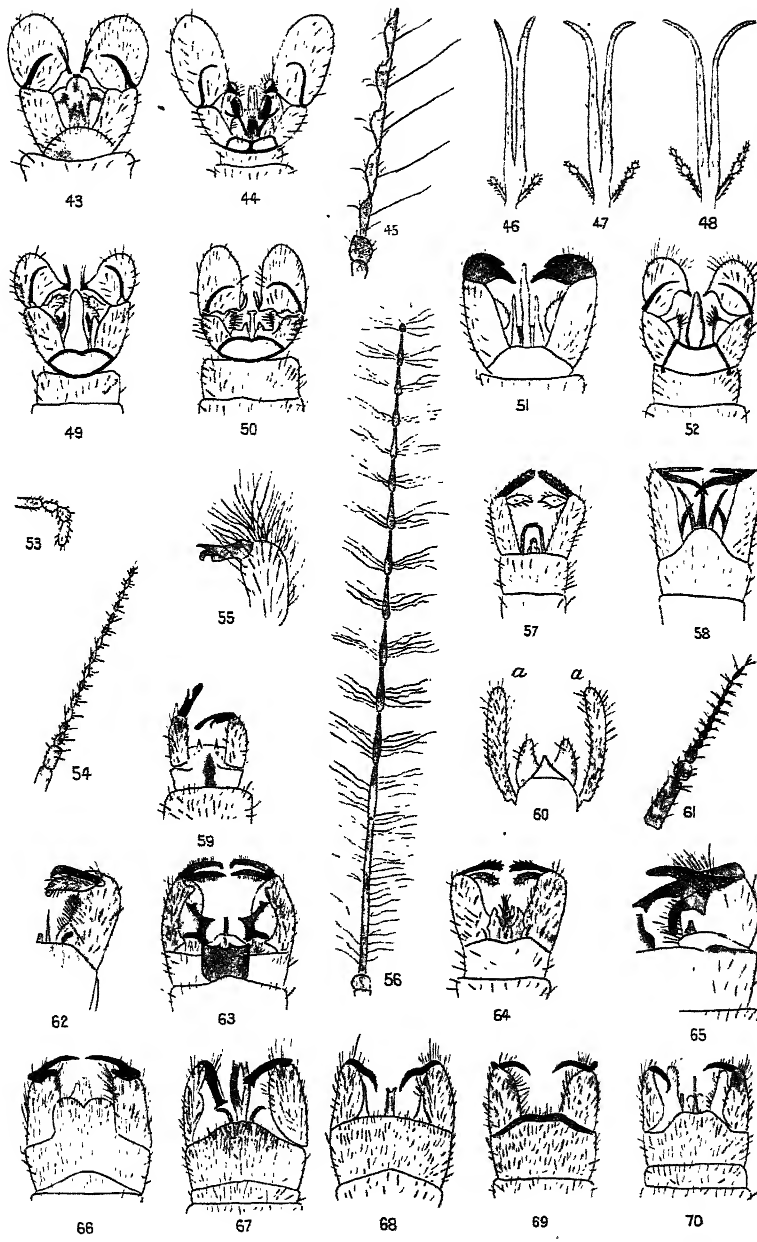
F.A.A. Skuse, del.

Baron & Gatward lith.



FAA Skuse, del.

Baron &



F.A.A. Skuse, del.

Baron & Gatward, lith.

lopis 2]. It is interesting to note in all sections the occurrence of genera common to North America and Europe; and from this we are led to surmise that very probably many other generic forms prevalent in these two continents also have Australian exponents.

Six Australian species have been characterized by former authors, chiefly by Walker, under the generic title *Limnobia*, but not one of these is a *Limnobia*; two belong to *Trimicra*, one to *Gnophomyia*, two probably to *Limnophila*, and one to *Amalopis*. The species of *Gnophomyia* above referred to is *Limnobia fascipennis*, Thom., described from a female example; Baron O.-Sacken subsequently described the male of the same species under its correct generic name, but as *G. cordialis* (Studies II., p. 199, 1887).

Section I. LIMNOBINA.*

"One submarginal cell; four posterior cells. Normal number of antennal joints fourteen (sometimes apparently fifteen). Eyes glabrous. Tibiæ without spurs at the tip. Ungues with more or less distinct teeth on the underside. Empodia indistinct or none." (Osten-Sacken).

A very natural group, including less than a dozen genera, four at least of which, *Dicranomyia*, *Geranomyia*, *Limnobia* and *Trochobola* are cosmopolitan. No species of LIMNOBINA have yet been described from Australia; a fair number are now characterized for the first time, amounting altogether to about one-fourth of the Tipulidæ brevipalpi herein enumerated, a proportion which obtains also in the North American and European faunas.

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* For further important particulars about the sections and genera, it is necessary that the student should consult the full descriptions by Baron O.-Sacken extant in his Monograph of the N. American Tipulidæ brevipalpi, also the subsequent observations in his "Studies on Tipulidæ," parts I. and II., published in the Berliner Entom. Zeits., 1886 and 1887; without which an adequate knowledge of the groups cannot be expected, but liability to serious blunder certainly the consequence.

Genus 1. Dicranomyia, Stephens.

Dicranomyia, Steph., Cat. Brit. Ins. 1829; Osten-Sacken, Mon. Dipt. N. Amer. IV. p. 53, 1869, pl. I, figs. 1, 2, 3 (wings), and pl. III. figs. 2, 3, 5 (genitalia); Studies II., p. 172, 1887.

" One submarginal cell; four posterior cells; discal cell present or absent; marginal cross-vein at the tip of the first longitudinal vein; tip of the auxiliary vein generally opposite or before the origin of the second longitudinal vein, seldom beyond it. Antennæ 14-jointed, joints sub-globular, elliptical, or short subcylindrical. Proboscis not longer than the head. Feet slender, tibiæ without spurs at the tip; empodia indistinct or none. The forceps of the male consists of two movable, soft, fleshy, subreniform lobes and a horny style under them." (Osten-Sacken).

This genus seems to be almost as numerously represented in Australia as it does in N. America and Europe. A few species have been described from New Zealand, one from Java, and one or two from South Africa. *Dicranomyia* also occurs in a fossil state in amber.

In all the specimens of Australian *Dicranomyiæ* examined by me, the discal cell is closed. The auxiliary vein usually terminates close to the origin of second longitudinal vein, but in *D. obscuripennis* and *annulipes* considerably beyond it; the position of the sub-costal cross-vein varies.. In *D. incisuralis* the sub-costal cross-vein connects the auxiliary vein with the costa. The first longitudinal vein is sometimes arcuated near its tip, thus causing an expansion of the sub-costal cell; this occurs in *D. punctipennis*, and in a less degree in one or two other species. The first longitudinal vein is continued somewhat beyond the marginal cross-vein and joined to the costa by a supernumerary cross-vein in *D. saxatilis*. In *D. Helmsi, marina, remota, obscuripennis, auripennis, zonata*, and *incisuralis* the first longitudinal vein arcuates into the second and appears joined to the costa by a cross-vein. The præfurca is more or less arcuated, sometimes angularly bent near its origin with a small stump of a vein; and it varies in length from once to four times the length of the distance between origin of third

longitudinal vein and small cross-vein; in most species it is short. Discal cell more or less square, usually longer than wide; in *D. punctipennis* about four times longer than wide. The great cross-vein usually close to or at the inner end of the discal cell, but in *D. remota* a distance more than its length before it.

290. DICRANOMYIA PUNCTIPENNIS, sp.n. (Pl. XXI., fig. 1).

♀.—Length of antennæ.......	0·050 inch ...	1·27 millimètres.
Expanse of wings.........	0·340 × 0·090...	8·62 × 2·27
Size of body..............	0·280 × 0·040...	7·10 × 1·01

Head, including rostrum, palpi and antennæ, brownish-black, the head pruinose with greyish; rostrum rather prominent. Thorax dull dusky brown, pruinose with greyish, with three umber-brown stripes, the lateral ones extending posteriorly beyond the suture; mesosternum dusky brown, pruinose with greyish. Halteres pallid, the club somewhat infuscated. Abdomen dark brown, ovipositor ferruginous-brown. Legs brown; coxæ ochraceous; femora more or less ochraceous for their basal half, those of the fore legs often entirely brown. Wings almost hyaline, stigma pale; origin and tip of all veins (except tips of third longitudinal vein and anterior branch of fourth longitudinal vein), and all cross-veins, slightly clouded with dark brown; seventh longitudinal vein somewhat bisinuated, with a very small brown spot on each curve above. Auxiliary vein reaching the costa beyond the origin of the præfurca, sometimes a distance equal to the length of marginal cross-vein; sub-costal cross-vein a little before origin of præfurca; first longitudinal vein suddenly strongly arcuated before its tip, the marginal cross-vein at the middle of this bend, and situated from the tip a distance usually rather greater than its length; the latter consequently shortened and straight; præfurca and that portion of third longitudinal vein before small cross-vein almost in straight line, both distances equal or the first a little longer; small cross-vein very short; discal cell closed, about four times longer than broad, the great cross-vein a little before, at, or somewhat beyond its inner end.

Hab.—Sydney, Berowra, Knapsack Gully, Blue Mountains, and Waterloo Swamps, near Sydney; July to September (Masters and Skuse).

Obs. 1.—I have before me only thirteen specimens of this rather remarkable species. The alar-venation is quite unlike any other species known to me, but somewhat resembles that of *D. longipennis*, Schum (Dipt. N. Amer. IV. pl. 1, f. 1). The wings, however, are of the usual shape.

Obs. 2.—In four specimens recently obtained at Woronora the vein-cloudings are almost entirely absent.

291. Dicranomyia saxatilis, sp.n. (Pl. xxi., fig. 2).

♀.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·320 × 0·085	...	8·12 × 2·14
Size of body.............	0·260 × 0·040	...	6·62 × 1·01

Head brown, sericeous with yellowish. Rostrum, palpi and antennæ deep brown; the former shorter than head; joints of antennæ globose, separated by very short pedicels; terminal joint ovate. Thorax brown, sericeous with yellowish, with two small brown spots below the humeri, and two short parallel longitudinal lines having their base on the transverse suture; pleuræ somewhat sericeous with yellowish; scutellum and metathorax dark brown. Halteres pale ochreous-yellow, slightly infuscated. Abdomen dark brown, sparingly clothed with a light pubescence; ovipositor and anal segment ochraceous, the lower valve deep brown at base. Legs ochraceous-brown, all the joints dark brown at the tips; tarsi infuscated. Wings with greyish or brownish cloudings, particularly along the veins; four sub-hyaline spots in the first basal cell, the third extending to and filling the basal half of inner marginal cell; a more or less indistinct sub-hyaline spot at the base of each cell ending at apex of wing; one in discal cell; a small rounded one beyond tip of seventh longitudinal vein; and lastly another small rounded one at the anal angle; stigma scarcely darker than the pale cloudings; veins yellowish-brown.

Auxiliary vein reaching costa a short distance beyond origin of second longitudinal vein; sub-costal cross-vein situated immediately before the origin; first longitudinal vein continued somewhat beyond the marginal cross-vein, joined to costa by a supernumerary cross-vein exactly in line with and half the length of the marginal cross-vein; præfurca arcuated near its base, not quite twice the length of distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein a short distance before its inner end.

Hab.—Near Coogee Bay, Sydney (Skuse). A single specimen.

Obs.—The peculiar wing-cloudings, thoracic markings, and character of the first longitudinal vein make this species easily distinguished.

292. Dicranomyia Helmsi, sp.n.

♂.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·300 × 0·080	...	7·62 × 2·02
Size of body..............	0·240 × 0·040	...	6·09 × 1·01
♀.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·350 × 0·090	...	8·87 × 2·27
Size of body..............	0·290 × 0·040	...	7·35 × 1·01

Head brown, sericeous with yellowish; rostrum, palpi and antennæ black; rostrum in ♂ rather shorter than, in ♀ as long as, the head. Thorax brown, sericeous with yellowish (shining when denuded of the bloom), the sericeous dust thickest at the sides, thus leaving a brownish median stripe; pleuræ, pectus, scutellum and metathorax sericeous with grey. Halteres pale, club infuscated. Abdomen dark brown, with the appearance of a yellowish or yellowish-grey bloom, sparingly clothed with yellowish pubescence; ♂ forceps inconspicuous, dark brown; ♀ ovipositor brownish-ochraceous. Legs blackish-brown, base of femora and the trochanters somewhat testaceous. Wings sub-hyaline, the veins almost imperceptibly clouded with pale greyish; stigma rather long, pale, indistinct; veins cinereous. Auxiliary vein

reaching costa a short distance before origin of second longitudinal vein; sub-costal cross-vein situated before tip of auxiliary vein a distance rather shorter than the length of great cross-vein; first longitudinal vein pale towards its tip, abruptly arcuating into second longitudinal at posterior end of stigma, joined to costa by a short pale cross-vein; præfurca very angularly bent near its base, with a short stump of a vein, and not twice the length of distance between the origin of third longitudinal vein and small cross-vein, in ♀ only $\frac{1}{3}$ longer than it; discal cell closed, the great cross-vein at its inner end.

Hab.—Mount Kosciusko, N.S.W., 5000 feet; March (Helms). *Two specimens in Coll. Australian Museum.*

Obs.—I have named this species after its discoverer, Mr. R. Helms, a most enthusiastic and skilful collector, engaged by the Trustees of the Australian Museum.

293. Dicranomyia obscura, sp.n.

♂.—Length of antennæ......	0·030 inch	...	0·76 millimètre.
Expanse of wings	0·270 × 0·065	...	6·85 × 1·66
Size of body..............	0·180 × 0·030	...	4·56 × 0·76
♀.—Length of antennæ......	0·045 inch	...	1·13 millimètres.
Expanse of wings	0·280 × 0·070	...	7·10 × 1·77
Size of body..............	0·240 × 0·035	...	6·09 × 0·88

Head brown, with a yellowish-grey bloom; rostrum, palpi and antennæ black. Thorax greyish-brown, dull, with three brown stripes; intermediate stripe broad, extending from collare to transverse suture; lateral ones apparently not extending beyond the suture; pleuræ with a somewhat yellowish-grey bloom. Halteres yellowish, the club usually infuscated. Abdomen more or less dusky brown; ♂ forceps and ♀ ovipositor obscure testaceous. Legs brown, the basal portion of femora ochreous or greyish-tawny; tip of tibiæ, and the tarsal joints, infuscated. Wings pellucid with a pale greyish tint, the stigma, cloudings on the

cross-veins, inner end of sub-marginal cells and origin of præfurca, darker greyish; origin of præfurca together with a small portion of first longitudinal vein and the tip of auxiliary vein often stained with deep brown; veins mostly sooty brown, the costa and first longitudinal vein obscure testaceous. Auxiliary vein reaching costa a little beyond origin of præfurca; sub-costal cross-vein near its tip; sub-costal cell uually very slightly wider at tip of first longitudinal vein on account of a slight arcuation of latter; marginal cross-vein a little before tip of first longitudinal vein; præfurca a little arcuated at base, about twice the length of distance between origin of third longitudinal vein and small cross-vein; discal cell closed, twice as long as broad; the great cross-vein situated more or less before its inner end.

Hab.—Sydney and Knapsack Gully, Blue Mountains; July to September (Masters and Skuse).

Obs.—I have five male and eleven female specimens before me for comparison; in one male specimen the wing-spots are entirely absent. This species at first sight closely resembles *D. punctipennis*.

294. DICRANOMYIA MARINA, sp.n. (Pl. XXI., fig. 3).

♂.—Length of antennæ........	0·030 inch	...	0·76 millimètre.
Expanse of wings..........	0·250 × 0·060	...	6·34 × 1·54
Size of body...	0·180 × 0·030	...	4·56 × 0·76
♀.—Length of antennæ........	0·035 inch	...	0·88 millimètre.
Expanse of wings..........	0·250 × 0·060	...	6·34 × 1·54
Size of body................	0·210 × 0·030	...	5·33 × 0·76

Head brownish, the eyes approximate above; rostrum, palpi and antennæ brownish; rostrum a little longer than the head. Thorax pale dull ochreous-yellow; with three light greyish-brown stripes; posterior portion, with scutellum and metathorax having a hoary bloom. Halteres pale ochreous or whitish. Abdomen dull brown or brownish; ♂ forceps (Pl. XXIV., fig. 43) and ♀ ovipositor ochreous or brownish-ochreous; valves of the latter straight. Legs

greyish or greyish-ochreous. Wings with a slightly milky tint, or exhibiting somewhat the appearance of ground glass; viewed at a certain obliquity the veins of anterior margin seem indistinctly lighter at intervals; veins greyish; stigma indistinct. Auxiliary vein reaching costa a little beyond origin of second longitudinal vein; subcostal cross-vein near its tip; first longitudinal vein arcuated into the second, joined to costa by cross-vein; præfurca at least twice the length of distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein situated at or somewhat before its inner end.

Hab.—Manly, near Sydney; March (Skuse).

Obs.—This insect was found very numerously on wet rocks and seaweed which are visited by the ocean spray at low tide and entirely covered by the water at high tide.

295. Dicranomyia remota, sp.n. (Pl. xxi., fig. 4).

♀.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·280 × 0·060	...	7·10 × 1·54
Size of body..............	0·260 × 0·030	...	6·62 × 0·76

Head, including rostrum, palpi and antennæ black; the tip of first joint of scapus, the entire second, and first two or three flagellar joints ochreous. Rostrum as long as the head. Thorax fulvous, levigate, with a brown median stripe; posterior portion, scutellum and metanotum pruinose, and except scutellum brownish; pleuræ pale fulvous. Halteres pale, the club infuscated. Abdomen brown, somewhat tinged with fulvous at the base and on the venter; ovipositor ferruginous. Legs light ochreous-brown; coxæ and basal portion of femora pale fulvous. Wings pellucid, clouded with brownish-grey and pale brown; the costal, sub-costal, both marginal cells and the sub-marginal cell almost entirely filled with pale brown; along the præfurca anteriorly, the stigma, and base of sub-marginal cell almost colourless; origin of second and third longitudinal veins, and bases of the branches of the fourth

longitudinal and all the cross-veins clouded with pale brown; posterior portion of wings faintly clouded with brownish-grey. Auxiliary vein reaching costa a little before origin of second longitudinal vein; sub-costal cross-vein situated before tip of auxiliary vein a distance equal to half the length of stigma; marginal cross-vein extremely indistinct, appearing as continuation of first longitudinal vein; præfurca angulated, not quite twice the length of distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein situated before the inner end a distance greater than its length.

Hab.—Middle Harbour, near Sydney; September (Skuse).

Obs.—I have taken but one specimen of this species.

296. Dicranomyia dorsalis, sp.n.

♂.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings.......	0·280 × 0·070	...	7·10 × 1·77
Size of body..........	0·210 × 0·030	...	5·33 × 0·76
♀.—Length of antennæ......	0·045 inch	...	1·13 millimètres.
Expanse of wings........	0·280 × 0·070	...	7·10 × 1·77
Size of body..............	0·250 × 0·030	...	6·34 × 0·76

Head and rostrum brown or yellowish-brown; palpi and antennæ dark brown or black; rostrum shorter than the head. Collare brown. Thorax fulvous or brownish-ochreous, somewhat shining, with three confluent brown or deep brown stripes, the lateral ones extending backwards beyond the suture; scutellum, metathorax and sternum brown or deep brown. Halteres infuscated, the base of the stem ochreous. Abdomen dark brown; ♂ forceps ochreous, testaceous or brownish; ♀ ovipositor short, pale at the base, the valves brown. Coxæ fulvous or ochreous. Remaining joints brown; femora usually paler at the tip; tibiæ and tarsi infuscated. Wings hyaline or nearly so; veins brown: stigma brownish-grey. Auxiliary vein reaching costa opposite or

a little beyond origin of second longitudinal vein; sub-costal cross-vein situated before its tip a distance nearly equal to length of stigma; marginal cross-vein pale, situated at distal end of stigma and tip of first longitudinal vein; præfurca arcuated, about one-third longer than distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein at its inner end.

Hab.—Generally distributed in N.S.W. (Masters and Skuse).

Obs.—In drawing up the above description I have a large series of (nearly one hundred) specimens for comparison. Not a single specimen has the discal cell open.

297. Dicranomyia obscuripennis, sp.n.

♂.—Length of ancennæ.......	0·065 inch	...	1·66 millimètres.
Expanse of wings........	0·250 × 0·065	...	6·34 × 1·66
Size of body	0·220 × 0·035	...	5·58 × 0·88

Head including rostrum, palpi and antennæ black; face somewhat ochraceous-brown. Joints of antennæ with very short pedicels, becoming slender and elongated towards apex. Thorax brown, sub-levigate; lateral callosity of metanotum and two hind pairs of coxæ ochre-yellow. Halteres black, ochre-yellow at base of stem. Abdomen dark brown, the ventral segments bordered with ochre-yellow posteriorly; ninth segment ochre-yellow; forceps dark brown; fleshy lobes rather small, the rostriform appendage with two long erect bristles. Legs black. Wings pellucid, with a blackish tint; veins and stigma dusky. Auxiliary vein extending beyond the origin of second longitudinal vein half the distance to marginal cross-vein; sub-costal cross-vein near its tip;* first longitudinal vein arcuating into the second longitudinal vein, and connected by the cross-vein to the costa; marginal cross-vein and tip of second longitudinal

*It is difficult to tell which is the cross-vein and which the tip of the auxiliary vein.

cutting middle of stigma; præfurca a little arcuated at base, about three times the length of distance from origin of third longitudinal vein to small cross-vein; sub-marginal cell about $\frac{1}{5}$ longer than the first posterior; discal cell closed, the great cross-vein close to its inner end.

Hab.—Elizabeth Bay, near Sydney (Skuse). August.

Obs.—I have obtained only a single specimen.

298. Dicranomyia auripennis, sp.n.

♂.—Length of antennæ	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·250 × 0·060	...	6·34 × 1·54
Size of body..	0·210 × 0·030	...	5·33 × 0·76

Head, including rostrum, palpi, and antennæ black. Rostrum as long as the head. Thorax fulvous or brownish-fulvous, levigate; pleuræ lighter fulvous. Halteres with a slightly infuscated club. Abdomen ochreous-brown, levigate, sparingly clothed with short yellow hairs; forceps brownish-yellow or somewhat fulvous. Legs brown; coxæ and basal portion of femora fulvous or brownish-yellow. Wings pellucid, with a yellowish tint, rather darker along anterior border between first longitudinal vein and costa, on anterior half between second longitudinal vein and costa, and extending downwards to the tip of the latter; brilliant margaritaceous reflections; stigma scarcely distinguishable. Auxiliary vein reaching the costa a little before or opposite the origin of the præfurca; sub-costal cross-vein pale, situated before the tip of auxiliary vein a distance equal to rather more than $\frac{2}{3}$ the length of the præfurca; marginal cross-vein indistinct, close to the tip of first longitudinal vein; the latter appearing as if incurved towards second longitudinal and joined by cross-vein to costa; præfurca about $\frac{1}{3}$ longer than the distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein before its inner end.

Hab.—Mossman's Bay, near Sydney (Skuse); Blue Mountains, N.S.W. (Masters). September.

Obs.—Two specimens were found at Mossman's Bay in a cave facing the sea, only a single specimen at the Blue Mountains. The tinted and beautifully iridescent wings make this species easily recognised. It is evidently uncommon.

299. Dicranomyia zonata, sp.n.

♂.—Length of antennæ	— inch	...	— millimètres.
Expanse of wings........	0·220 × 0·055	...	5·58 × 1·39
Size of body...............	0·210 × 0·030	...	5·33 × 0.76

Antennæ wanting. Head, including rostrum and palpi, deep brown or black, the front hoary. Rostrum prominent, shorter than head. Thorax light brown, the humeri and posterior half of metanotum ochreous-yellow; a deep brown stripe laterally from collare to base of halteres, bordered beneath (including coxæ) with pale ochre-yellow; the mesosternum deep brown. Halteres deep brown, base of stem pale ochre-yellow. Abdomen deep brown, all segments bordered posteriorly with yellow equally distinctly above and beneath; levigate, with yellowish hairs; forceps deep brown. Legs, including trochanters, deep dusky brown. Wings pellucid, faintly tinged with brownish-grey; stigma elliptical, deep fuscous; veins deep fuscous; apex of wing and cross-veins a little infuscated. Auxiliary vein extending a short distance beyond origin of second longitudinal vein; subcostal cross-vein near its tip; first longitudinal vein ending in second longitudinal, connected by an indistinct cross-vein to costa scarcely beyond middle of stigma; præfurca moderately long, almost rectangularly bent near its origin, with a stump of a vein at the angle; sub-marginal cell about $\frac{1}{5}$ longer than first posterior cell; discal cell closed, the great cross-vein close to its inner end.

Hab.—Blue Mountains, N.S.W. (Skuse). One specimen.

300. Dicranomyia incisuralis, sp.n.

♀.—Length of antennæ.......	0·040 inch	...	1·01 millimètres.
Expanse of wings.........	0 210 × 0·050	...	5·33 × 1·27
Size of body..............	0 200 × 0·025	...	5·08 × 0·62

Head brown, pruinose with yellowish. Rostrum, palpi and antennæ black. Thorax ochreous with three brown stripes, lateral ones extending posteriorly beyond the suture; pleuræ with a brown stripe from beneath the humeri to the base of the halteres; prosternum with an oblong brown spot between the fore coxæ; mesosternum with two oblong brown spots between the intermediate coxæ; scutellum and metanotum brown or brownish. Halteres ochreous, the club infuscated. Abdomen brown; incisions between the superior segments ochreous-yellow, widened into roundish patches on the venter; ovipositor brownish-ferruginous, lower valves deep brown or black at the base, ochreous-yellow before their insertion. Legs brown; coxæ ochreous; femora pale at base and somewhat darker at apex. Wings pellucid with a pale brownish tint, the origin and tip of second longitudinal vein, origin of third longitudinal and the cross-veins somewhat clouded with brownish; stigma roundish, brown, very distinct. Auxiliary vein reaching the costa a little beyond the origin of second longitudinal vein, appearing as if incurved towards first longitudinal vein and connected before its tip by the cross-vein to costa; first longitudinal vein arcuated into the second longitudinal vein through the middle of stigma, and joined to costa by cross-vein; præfurca, also third longitudinal vein, angularly bent near the base (remaining portion almost straight), with a small stump of a vein at the angle (these small stumps are exhibited in all three specimens before me); præfurca varying from 2½ to nearly 4 times the length of distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein before or at its inner end.

Hab.—Wheeney Creek, Hawkesbury Dist. (Skuse); Sydney and Berowra (Masters). January.

Obs.—A single specimen was taken in each of the above-named localities. Closely allied to *D. zonata*, but certainly distinct.

301. Dicranomyia viridiventris, sp.n.

♂.—Length of antennæ.....	0·040 inch	...	1·01 millimètres.
Expanse of wings........	0·250 × 0·050	...	6·34 × 1·27
Size of body...............	0·180 × 0·025	...	4·56 × 0·62
♀.—Length of antennæ......	0·037 inch	...	0·92 millimètre.
Expanse of wings........	0·250 × 0·050	...	6·34 × 1·27
Size of body...............	0·195 × 0·030	...	4·93 × 0·76

Head yellowish to brownish; rostrum shorter than the head, yellowish to brownish; palpi and antennæ brown; the first joint of scapus sometimes ochreous. Thorax pale greenish-yellow, sometimes darker (in one specimen even reddish-brown), shining, with indistinct traces of an intermediate stripe. Halteres pale green, the club very slightly darker. Abdomen green; ♂ forceps usually concolorous with rest of abdomen; ♀ ovipositor short, ochreous-brown. Legs yellowish or greenish-yellow; tibiæ and tarsi greyish. Wings hyaline; veins brownish; stigma greyish, sometimes indistinct. Auxiliary vein reaching costa opposite or somewhat before origin of second longitudinal vein; sub-costal cross-vein situated more than half the length of stigma distant from its tip; marginal cross vein at tip of first longitudinal vein; præfurca arcuated, only a little longer than distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein at or somewhat beyond its inner end.

Hab.—Middle Harbour, near Sydney (Skuse). Three specimens.

Obs.—Three specimens captured by me at Knapsack Gully, Blue Mountains, appear to belong to this species, but they are too shrivelled to satisfactorily examine.

302. Dicranomyia cuneata, sp.n. (Pl. xxi., fig. 5).

♂.—Length of antennæ......	0·035 inch	...	0·88 millimètre.
Expanse of wings........	0·200 × 0·045	...	5·08 × 1·13
Size of body...............	0·140 × 0·016	...	3·55 × 0·40

Front, antennæ, and palpi brown; rostrum yellowish; terminal joint of antennæ with a slender cylindrical prolongation. Thorax pale brownish-ochreous, sub-nitidous; pleuræ paler ochreous, with an almost imperceptible greenish tint. Halteres long (1·01 mm.), slender, infuscated, pale at the base of stem. Abdomen olive-brown, the forceps very little paler. Legs dusky brown, the coxæ and extreme base of femora pale greenish-ochreous. Wings narrow, lanceolate, almost hyaline, with a slight greyish tint; stigma almost invisible; veins brown. Auxiliary vein reaching costa a little beyond origin of second longitudinal vein; sub-costal cross-vein situated before the tip of auxiliary vein a distance equal to rather more than half the length of præfurca; marginal cross-vein situated at tip of first longitudinal vein; præfurca about $2\frac{1}{2}$ times the length of distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein at or before its inner end.

Hab.—Blue Mountains N.S.W. (Skuse). One specimen.

Obs.—The wings are considerably broader at the apex than those of *D. longipennis*, Schum; the basal portion is similar. The above-described · appears closely allied to *D. halterata*, O.S. (Dipt. N. Amer. IV. p. 71).

303. Dicranomyia annulipes, sp.n.

♂.—Length of antennæ.......	0·040 inch	...	1·01 millimètres.
Expanse of wings.........	0·210 × 0·055	...	5·33 × 1·39
Size of body...............	0·140 × 0·025	...	3·55 × 0·62

Head, including rostrum, palpi and antennæ, deep brown, almost black. Thorax dull brown, somewhat sericeous on posterior portion, and also on scutellum and metanotum; pleuræ dull brown. Halteres fulvous. Abdomen ochreous-brown, the segments bordered at the sides with brown, tolerably well clothed with yellow hairs; forceps bright fulvous. Legs pale ochreous-brown; femora with a darker ring before apex, slightly paler a little before and after the ring; tibiæ and all tarsal joints tipped with deep brown

or black. Wings pellucid, with a slightly greyish tint, and rather indistinctly clouded with brownish; two very pale spots in first basal cell, one mid-way between humeral cross-vein and origin of præfurca, the other immediately beneath origin of præfurca; bases and tips of all the veins, and the cross-veins, more or less distinctly clouded; stigma elliptical, pale brownish; veins dark brown, the costa more fulvous. Auxiliary vein reaching the costa beyond the origin of second longitudinal vein a distance about equal to length of stigma; sub-costal cross-vein about midway between origin of second longitudinal vein and tip of auxiliary vein; marginal cross-vein close to tip of second longitudinal vein; præfurca about twice the length of the distance between origin of third longitudinal vein and small cross-vein; discal cell closed, the great cross-vein a little before its inner end.

Hab.—Hexham Swamps, near Newcastle, N. S. W.; April (Skuse).

Genus 2. THRYPTICOMYIA, gen. nov.

One sub-marginal cell; four posterior cells; discal cell present; marginal cross-vein before tip of first longitudinal vein; tip of auxiliary vein opposite origin of second longitudinal vein; præfurca as long as sub-marginal cell; a supernumerary cross-vein between the costa and the auxiliary vein. Wings lanceolate, very narrow towards the base. Antennæ 14-joined, joints sub-cylindrical; joints pedicelled; each joint with a moderately long stiff hair above (Pl. XXIV, fig. 45). Proboscis very short. Feet slender; tibiæ without spurs; ungues extremely minute with a tooth near the base; empodia wanting. Forceps of male similar to those of *Dicranomyia* (Pl. XXIV, fig. 44); two fleshy lobes with a horny style under them.

This genus though undoubtedly very closely allied to *Dicranomyia* may be readily distinguished by the structure of the antennæ, the cuneiformly narrowed base of the wings which has not the slightest indication of an anal angle, by the greater length of the first longitudinal vein and position of the marginal cross-vein, and lastly by the presence of a supernumerary sub-costal cross-vein.

304. THRYPTICOMYIA AUREIPENNIS, sp.n. (Pl. XXI., fig. 6).

♂.—Length of antennæ......	0·050 inch ...	1·27 millimètres.
Expanse of wings.........	0·190 × 0·040...	4·81 × 1·01
Size of body..............	0·165 × 0·020...	4·18 × 0·50

Head and antennæ brown; rostrum and palpi ochreous or brownish. Thorax short and arcuated, light ochreous-brown, somewhat darker in the mesonotum; sub-levigate. Halteres long, slender, infuscated, pale at the base of stem. Abdomen including forceps brown. Legs very slender. Coxæ and extreme base of femora ochreous; remaining joints brown, the tip of first tarsal joint and whole of last four joints white. Wings sub-hyaline, with extremely brilliant, chiefly golden, reflections; veins and stigma brown. Auxiliary vein reaching costa opposite origin of second longitudinal vein; sub-costal cross-vein a short distance (the length of marginal cross-vein) from its tip; supernumerary cross-vein situated about opposite inner end of first posterior cell; first longitudinal vein disappearing before end of stigma, the latter enveloping this vein from opposite inner end of sub-marginal cell; marginal cross-vein situated before tip of first longitudinal vein a distance at least equal to its length; præfurca slightly arcuated at its origin; discal cell usually longer than broad, sometimes nearly square; its inner end usually somewhat before inner end of first posterior cell, and its anterior angle sometimes with a small stump of a vein; great cross-vein situated about its middle.

Hab.—Sydney; six specimens (Masters).

Obs.—This insect has a very delicate aërial appearance.

Genus 3. GERANOMYIA, Haliday.

Geranomyia, Hal., Entom. Mag. I. p. 154, 1833; Curtis, Brit. Entom. XII. p. 573, 1835; *Limnobiorrhynchus*, Westw., Ann. Soc. Ent. Fr. 1835, p. 684; Trans. Ent. Soc. Lond. 1881, p. 375; *Aporosa*, Macquart, Dipt. Exot. I., p. 62, 1838; Loew, Linn.

Entom. V. p. 394, tab. II. f. 9-12, 1851; *Geranomyia*, Hal., Ins. Brit. iii. p. 310, 1856; *Plettusa*, Philippi, V. z.-b. G. Wien, p. 597, t. XXIII. f. 1, 1865; *Geranomyia*, O.-Sacken, Mon. Dipt. N. Amer. IV. p. 78, 1869; Wulp, v.d., Dipt. Neerl. p. 396, t. XII., f. 5-6, 1877; O.-Sacken, Studies, II. p. 173, 1887.

"One sub-marginal cell; four posterior cells; a discal cell. Antennæ 14-jointed, sub-moniliform; joints not pedicelled. Rostrum and proboscis prolonged, longer than the head and thorax taken together; the short palpi inserted about their middle. Feet slender; tibiæ without spurs at the tip; empodia indistinct or none; ungues with teeth on the under side. The forceps of the male like that of *Dicranomyia*, and consists of two fleshy, movable lobes, with horny appendages and a horny style under them." (Osten-Sacken).

Four species which I refer to this genus differ in the number of joints to the palpi; one species has only biarticulate palpi, two have them 3-jointed, whilst another has them 4-jointed. These differences compel me to suggest the institution of three sub-generic groups; in other respects these insects do not more than specifically differ from hitherto described *Geranomyiæ*. There has always seemed some doubt about the number of joints to the palpi. Haliday first of all believed them to consist of but one minute joint. Baron Osten-Sacken takes them to be biarticulate on the authority of Curtis; but the latter author himself queries the statement in his generic diagnosis. Having not a specimen of any described species it is impossible for me to more than surmise that upon careful examination the known examples, of which the majority prevail on the American continent, will be found to differ in the number of joints comprised in the palpi. The type of the genus, *G. unicolor*, Hal., probably has, but possibly may not have, only biarticulate palpi; and Curtis errs when he states that they are "attached to the anterior angles of the mentum." They are in reality attached to the sides of the labium below the point where the latter divides. The labium with the palpi can be drawn away from the other organs upon careful dissection.

Rostrum the length of the thorax only in *G. lutulenta* and *annulata;* as long as the thorax and head taken together in *G. picta* and *fusca.* Antennæ rather short, joints elliptical, sessile; sub-cylindrical in *G. fusca.* The basal joint of the palpi is always long and slender, about twice the length of the second joint (Pl. XXIV., figs. 46-48).

Venation similar to that of *Dicranomyia.* Auxiliary vein in *G. picta* reaching costa nearly opposite but somewhat beyond origin of præfurca, in the other species reaching considerably beyond. Sub-costal cross-vein always close to the tip of the auxiliary vein. The second longitudinal vein is rather angularly bent near its origin in the four species known to me, in *G. picta* and *annulata* with even a short stump of a vein at the angles. The sub-marginal cell is much longer than the first posterior cell. The discal cell is open in one specimen of *G. lutulenta,* and coalesces with the *third* posterior cell. In *G. picta* the great cross-vein is situated considerably before the inner end of discal cell.

In the male forceps the rostriform appendage of the fleshy lobes bears two short stiff bristles; in *G. fusca* this is situated much lower down the lobe than usual. The falciform appendages are long and curved. The anal style is large in *G. picta* (Pl. XXIV., fig. 49), but small and hammer-shaped in *fusca* (Pl. XXIV., fig. 50). These differences however may be only of specific importance.

Until further species have been studied it is impossible to fully define the three following sub-genera; other characters may be ultimately found to be constantly associated with the differences in the palpi.

1. Sub-genus *Geranomyia.* Palpi two-jointed. Proposed for the single species *G. picta* (Pl. XXIV., fig. 46).

2. Sub-genus *Triphana.* Palpi three-jointed. Proposed for the reception of two species, *G. lutulenta* and *annulata* (Pl. XXIV. fig. 47).

3. Sub-genus *Tetraphana.* Palpi four-jointed. One species, *G. fusca* (Pl. XXIV., fig. 48).

305. Geranomyia (Geranomyia) picta, sp.n.

♂.—Length of antennæ	0·060 inch ...	1·54 millimètres.
Expanse of wings.........	0·220 × 0·050 ...	5·58 × 1·27
Size of body..............	0·240 × 0·030 ...	6·09 × 0·76
♀.—Length of antennæ.......	0·050 inch ...	1·27 millimètres.
Expanse of wings.........	0·240 × 0·050 ...	6·09 × 1·27
Size of body..............	0·210 × 0·030 ...	5·33 × 0·76

Head, including proboscis, palpi and antennæ black; front with a greyish bloom. Palpi two-jointed. Collare brown. Thorax fulvous-brown, with a greyish bloom, traversed by three brown longitudinal stripes; the intermediate stripe extending to posterior border of metanotum. Halteres with infuscated club. Abdomen brown, ochreous or fulvous-brown on the venter; genitalia fulvous or brownish-ochreous. Coxæ fulvous; femora testaceous, darker at the tip; tibiæ and tarsi obscure testaceous, the terminal joint of latter infuscated. Wings pellucid, with a slight tint; the stigma and two spots on the distal half of anterior border brown; a small squarish spot at origin of præfurca, and a longish one on the costa beginning a short distance beyond stigma, and terminating at tip of third longitudinal vein; the cross-veins, inner ends of sub-marginal and sub-costal cells and fifth longitudinal vein clouded. Auxiliary vein reaching costa a little beyond origin of second longitudinal vein; præfurca angularly bent near its origin, generally with a small stump of a vein; marginal cross-vein and tip of first longitudinal vein pale, the latter arcuated into second longitudinal; sub-marginal cell nearly one-third longer than the first posterior; discal cell closed; the great cross-vein situated much before its inner end, and usually opposite inner end of first sub-marginal cell.

Hab.—Knapsack Gully, Blue Mts.; North Waratah, near Newcastle, and Middle Harbour, near Sydney; six specimens (Skuse).

306. Geranomyia (Triphana) lutulenta, sp.n.

♀.—Length of antennæ......	0·070 inch	...	1·77 millimètres.
Expanse of wings........	0·350 × 0·090	...	8·89 × 2·27
Size of body..............	0·280 × 0·040	...	7·10 × 1·01

Brown. Head including rostrum, palpi and antennæ black; front with a greyish bloom. Palpi three-jointed. Thorax levigate, more or less ochreous or ochreous-brown at humeri; pleuræ with greyish bloom. Halteres infuscated, the base of stem ochreous-yellow. Ovipositor obscure testaceous. Coxæ and femora testaceous, the latter brown at the tip; tibiæ and tarsi obscure testaceous or brownish, all the joints tipped with brown; except the last three tarsal joints entirely blackish. Wings with a slightly greyish tint, with small indistinct greyish cloudings; stigma same tint as clouds; first and fifth longitudinal veins marked with brown near the base of wing; a squarish greyish cloud at origin of second longitudinal vein reaching costa anteriorly and fourth longitudinal vein posteriorly; a small cloud enveloping tip of auxiliary vein and neighbouring portion of the first longitudinal vein; a roundish cloud at base of sub-marginal cell, enveloping extremity of præfurca, and coalescing with stigma; cross-veins and both ends of discal cell also clouded; veins brown, the costa and first and fifth longitudinal veins yellowish, but the first longitudinal brown where enveloped by cloudings. Auxiliary vein reaching costa opposite middle of præfurca; sub-costal cross-vein a short distance from its tip; præfurca angulated near its origin; discal cell closed, or opened posteriorly; the great cross-vein at or before its inner end.

Hab.—Mount Kosciusko, N.S.W., 5000 ft.; March (Helms).

Two specimens in Coll. Australian Museum.

Obs.—This is the only species in which I have observed the discal cell open among all the Australian Limnobina examined by me.

307. Geranomyia (Triphana) annulata, sp.n.

♂.—Length of antennæ.......	0·050 inch	...	1·27 millimètres.
Expanse of wings.........	9·280 × 0·065	...	7·10 × 1·66
Size of body..............	0·250 × 0·030	...	6·34 × 0·76

Head, including proboscis, palpi and antennæ dusky brown. Palpi three-jointed. Thorax fulvous-brown, shining, with three brown stripes; the intermediate stripe terminating before the suture; metathorax with hoary bloom; collare and pleuræ brown. Halteres with infuscated club. Abdomen brown; the forceps paler. Legs testaceous; fore femora with a brown ring at the tip, the intermediate and hind pairs with a narrow ring before the tip; terminal joints of tarsi somewhat infuscated. Wings almost hyaline; stigma and two spots brownish; the spots small, cloud-like; one at origin of second longitudinal vein, and the other enveloping tip of auxiliary vein, the sub-costal cross-vein and portion of first longitudinal; inner end of sub-marginal cell and veins indistinctly clouded. Auxiliary vein reaching costa nearer opposite inner end of sub-marginal cell than to origin of second longitudinal vein, and opposite tip of sixth longitudinal vein; sub-costal cross-vein close to its tip; præfurca angularly bent near its origin, with a short stump of a vein; tip of first longitudinal and marginal cross-vein pale, the former apparently very abruptly arcuated into second longitudinal vein; sub-marginal cell nearly one-fifth longer than first posterior cell; discal cell closed; the great cross-vein situated before its inner end a distance less than its length, and opposite inner end of sub-marginal cell.

Hab.—Berowra, N.S.W.; a single specimen (Skuse).

308. Geranomyia (Tetraphana) fusca, sp.n.

♂.—Length of antennæ......	0·070 inch	...	1·77 millimètres.
Expanse of wings........	0·310 × 0·080	...	7·87 × 2·02
Size of body..............	0·250 × 0·040	...	6·34 × 1·01

♀.—Length of antennæ......	0·065 inch	..	1·66 millimètres.
Expanse of wings........	0·320 × 0·080	...	8·12 × 2·02
Size of body..............	0·290 × 0·040	...	7·35 × 1·01

Dark brown. Head, including proboscis, palpi and antennæ sometimes black. Palpi four-jointed. Thorax light brown at the humeri; an intermediate brown stripe visible anteriorly. Halteres brown, somewhat ochreous at the base of stem. Abdomen blackish-brown; ♂ forceps concolorous with rest of body; ♀ ovipositor rather short, straight, the valves obscure testaceous. Legs entirely brown. Wings with a slight greyish tint, with very pale greyish-brown clouds; the stigma slightly darker; a squarish cloud at origin of second longitudinal vein, reaching costa anteriorly and fourth longitudinal posteriorly; a cloud between stigma and lower extremity of great cross-vein; and another at distal end of discal cell; the costa at end of marginal and sub-marginal cells somewhat clouded; veins dark brown. Auxiliary vein reaching costa more or less opposite middle of præfurca; sub-costal cross-vein near its tip; tip of first longitudinal and the marginal cross-vein pale; præfurca much angulated near its orgin; great cross-vein at inner end of discal cell.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). January.

Genus 4. Limnobia, Meigen.

Limnobia, Meig., Syst. Beschr. I. p. 116, 1818; *Limonia*, Meig., Ill. Mag. II. p. 262, 1803; *Limnobia* and *Glochina*, Meig., Syst. Beschr. VI. pp. 275-280, 1830; *Idioptera*, *Limnophila*, and *Limnobia*, Macquart, S.à B. I. pp. 94, 95, 100, 1834; Walker, Ins. Brit. III. p. 280, 1856; Zetterstedt, F. Lapp. 1840, Dipt. Scand. X. 1851; *Limnobia* (in its restricted sense), Stephens, Cat. Brit. Ins. 1829; O.-Sacken, Mon. Dipt. N. Amer. IV. p. 84, 1869; Studies, II. p. 177, 1887.

"One submarginal cell; four posterior cells; a discal cell. The marginal cross-vein is sometimes at the tip of the first longitudinal

vein, but often at some distance anterior to this tip, crossing the stigma; the tip of the auxiliary vein is usually far beyond the origin of the præfurca. Antennæ 14- (often apparently 15-) jointed. Feet comparatively strong; tibiæ without spurs at the tip; empodia indistinct or none; ungues with several teeth on the under side, giving them a pectinate appearance. The forceps of the male consists of two horny, movable hooks, and a horny style under them." (Osten-Sacken).

The species hereafter described seems to differ from typical *Limnobiæ* in having the general appearance of a *Dicranomyia*, being of moderate size, dull-coloured, etc.; also, the ungues do not exhibit a pectinate appearance, showing only indistinctly two minute teeth near the base. It is all the more remarkable that this species should be so *Dicranomyia*-like, as it belongs to the section having the cross-vein close to the tip of the first longitudinal vein, this latter character being always associated with the typical highly coloured *Limnobiæ*,* whilst in antennæ, structure of male forceps, and length of auxiliary vein it is a true *Limnobia*.

309. LIMNOBIA BIDENTATA, sp.n.

♂.—Length of antennæ......	0·070 inch	...	1·77 millimètres.
Expanse of wings.........	0·300 × 0·080	...	7·62 × 2·02
Size of body..............	0·310 × 0·040	...	7·87 × 1·01
♀.—Length of antennæ.......	0·070 inch	...	1·77 millimètres.
Expanse of wings.........	0·320 × 0·085	...	8·12 × 2·14
Size of body..............	0·310 × 0·042	...	7·87 × 1·06

Head, including rostrum, palpi and antennæ black; rostrum short; first joint of scapus twice the length of the second. Thorax dark fuscous-brown, sometimes almost black with a greyish bloom; pleuræ and humeri sometimes slightly tinged with testaceous. Halteres testaceous, the club almost black. Abdomen

* Though also a character of the *Dicranomyiæ*.

deep brown or black, sparingly clothed with very short yellowish hairs; ♂ forceps (Pl. xxiv., fig. 51) concolorous with rest of body; ♀ ovipositor rather slender, slightly curved, the valves reddish-brown. Legs obscure testaceous; femora with a broad ring of brown at tip; tibiæ and first two tarsal joints slightly tipped with, and three last joints entirely, brown or black. Wings pellucid, with brownish tint; veins dark fuscous-brown, the præfurca and cross-veins clouded with brownish; costal cell, and distal half of marginal cell, also brownish; stigma small, round, dark fuscous, enveloping the tip of first longitudinal and marginal cross-vein. Auxiliary vein reaching costa opposite inner end of sub-marginal cell; sub-costal cross-vein close to its tip; first longitudinal vein abruptly arcuated into the second, joined to the costa by the cross-vein; the latter rather indistinct and pale; præfurca arcuated, sometimes with a small stump of a vein, about one-third longer than distance from origin of third longitudinal vein to small cross-vein; great cross-vein situated more or less before middle of discal cell; sixth longitudinal vein straight or nearly so; seventh a little arcuated at the tip.

Hab.—Gosford, Woronora and Manly, near Sydney (Skuse); Blue Mts. (Masters). January to March. Eighteen specimens.

Genus 5. Trochobola, Osten-Sacken.

Discobola, O.-Sack., Proc. Ent. Soc. Philad. p. 226, 1865; *Trochobola*, O.-Sack., Mon. Dipt. N. Amer. IV. p. 97, 1868; Studies, II. p. 178, 1887.

"One sub-marginal cell; four posterior cells; a discal cell; the tip of the auxiliary vein is far beyond the origin of the second longitudinal vein; the marginal cross-vein is some distance anterior to the tip of the first longitudinal vein; a supernumerary cross-vein connects the sixth and seventh longitudinal veins. Antennæ 14-jointed. Feet slender; tibiæ without spurs at the tip; empodia indistinct; ungues with teeth on the under side." (Osten-Sacken).

Three species belonging to this genus have been described, two occurring in Europe and one in North America; and according to Baron Osten-Sacken the genus also occurs in New Zealand. All known species exhibit a wonderful similarity and are difficult to separate; the wings are marked with numerous ocellate spots which vary little more in the different species than they do in individuals.

Prof. Mik (Verh. z.-b. Ges. in Wien, XXVIII. p. 617, 1879) discusses the described species, and establishes the distinction between the two European species by the structure of the male forceps and character of the wing-markings.

The species now described from Australia seems more closely related to *T. cæsarea*, O.-Sack., than to *annulata*, Linn. They agree very well in the picturing of the wings, except that *T. australis* has not the marmorated second basal cell so characteristic of *cæsarea*. The auxiliary vein (judging by Prof. Mik's figures) is not so long, the second longitudinal vein is more arcuated, and the third longitudinal vein more strongly converges towards the fourth. On the other hand, the structure of the holding forceps is more like that of *T. annulata*, possessing the rostriform appendage; it differs, however, in having the upper margin of the anal segment emarginate, and not dentate as in both European species.

310. TROCHOBOLA AUSTRALIS, sp.n. (Pl. XXI., fig. 7).

♂.—Length of antennæ......	0·070 inch	...	1·77 millimètres.
Expanse of wings........	0·340 × 0·080	...	8·62 × 2·02
Size of body	0·250 × 0·030	...	6·34 × 0·76

Head, including rostrum, palpi and antennæ, black. Collare ochreous-yellow. Thorax ochreous-yellow, almost covered with three broad brown stripes, levigate; pleuræ and metathorax dark brown; scutellum deeply bordered with brown. Halteres brown, the club and base of stem pale. Abdomen brown or brownish-ochreous (greenish-yellow while living), the first segment ochreous

yellow; genitals concolorous with rest of abdomen; fleshy lobes of ♂ forceps (Pl. xxiv., fig. 52), with a short rostriform appendage, the upper margin of horny plate between bases of basal pieces with a shallow emargination (not dentate as in *T. annulata* and *cæsarea*). Legs testaceous; femora with a brown or black ring before the tip, preceded and followed by ochreous-yellow; tip of tibiæ and terminal joints of tarsi brown or black. Wings broad, with a pale yellowish tint, with brown (blackish while fresh) ocellate cloudings; the greater portion of second basal cell, and a transverse recurved band across the middle of wing, clear of markings (except that there is the pupil of an incomplete ocellus at tip of sixth longitudinal vein); an almost complete ocellus, broken at the costa, has its pupil at the origin of second longitudinal vein; another almost complete one has the supernumerary cross-vein for its centre; the distal half of the wing is covered with more or less confluent ocelli, the centre spots of the most distinct being at sub-costal cross-vein, small cross-vein, basal half of great cross-vein and the cross-vein closing discal cell; a brown spot on the costa near base of wing encloses a pale spot at or somewhat beyond the humeral cross-vein; and another enveloping tip of first longitudinal and marginal cross-vein has a pale spot just before the tip of the former. Auxiliary vein reaching costa a short distance before inner end of sub-marginal cell; sub-costal cross-vein a short distance before its tip; first longitudinal vein arcuated towards its tip, forming a considerable expansion of the sub-costal cell; third longitudinal vein considerably converging towards the fourth at its tip.

Hab.—Sydney and Como, N.S.W. (Skuse); Waverley, near Sydney; October (Froggatt). Three male specimens.

Obs.—Baron O.-Sacken remarks that he knows at least three easily distinguishable species from S. E. Australia and New Zealand; the above-described is unfortunately the only one I have been able to find, and that only rarely.

Genus 6. Libnotes, Westwood.

Libnotes, Westw., Trans. Ent. Soc. Lond. 1876, p. 505, pl. III. fig. 6 b.; O.-Sacken, Studies II., p. 179, 1887.

One submarginal cell; four posterior cells; a discal cell; cells at distal half of wing of remarkable length and curvature; præfurca extremely short. Marginal cross-vein at or near the tip of the first longitudinal vein; the tip of the auxiliary vein far beyond the origin of the præfurca. Antennæ 14-jointed, the terminal joint with a slender elongation. Legs long, slender; tibiæ without spurs at the tip; empodia wanting; ungues dentate. Male forceps of similar structure to those of *Limnobia.*

311. LIBNOTES STRIGIVENA, Walker (Pl. XXI., fig. 8).

Limnobia strigivena, Walk., Journ. Linn. Soc. Lond. Vol. V., 1861, p. 229; *Libnotes strigivena,* O.-Sacken, Studies II., 1887, p. 183.

♂.—Length of antennæ.......	0·080 inch	..	2·02 millimètres.
Expanse of wings.......	0·600 × 0·095	...	15·24 × 2·39
Size of body	0·350 × 0·055	...	8·89 × 1·39
♀.—Length of antennæ......	0.080 inch	...	2·02 millimètres.
Expanse of wings..	0·500 × 0·095	...	12·70 × 2·39
Size of body. ..,..........	0·350 × 0·055	...	8·89 × 1·39

Pale ochreous-yellow. Antennæ and palpi somewhat tinged with brownish; flagellar joints elliptical. Thorax, with the mesonotum, and lateral border to origin of wings, brown; more or less distinct traces of a double median stripe; a brownish triangular spot on each side above the origin of the wings; a small spot about equal in size to the last on the pleuræ; metanotum with a narrow lateral border of brown, which is continued as a brown line down the sides of the abdominal segments*; second segment with a median brownish marking; ♀ ovipositor short, little curved, ochraceous-brown. Fore coxæ bordered with brown anteriorly; femora with a more or less distinct brown ring a little before the

* The lateral line and thoracic markings are occasionally very indistinct, whilst in old specimens the sides of the segments of the abdomen sometimes overlap, and thus entirely conceal the line.

apex; tibiæ and first two tarsal joints at tip, and last three joints entirely, brown or blackish. Wings almost hyaline, somewhat opaline; veins pale ochreous (imparting a somewhat whitish appearance to the wings), marked with numerous small longitudinal brown spots, the two most distinct on the first longitudinal vein at origin of second longitudinal and tip of auxiliary vein; distal end of stigma, with tip of first longitudinal vein, slightly infuscated. Auxiliary vein joining costa almost opposite tip of fifth longitudinal vein; sub-costal cross-vein at its tip; marginal cross-vein close to tip of first longitudinal vein; inner end of second posterior cell much arcuated or rectangular, situated much before that of the third, with slight trace of a small stump of a vein at its angle; discal cell long and narrow, the great cross-vein at about one-third its length.

Hab.—Barron and Mulgrave Rivers, N. Queensland (Froggatt); also Fiji Islands. Five specimens.

Obs.—I believe this insect to be the same as *L. strigivena*, described by Walker, from Dorey, New Guinea. In arriving at this conclusion I have been greatly assisted by the additional notes on the venation of the wings in the table given by Baron O.-Sacken, (Studies, II. p. 183). A single specimen in the Macleay Museum labelled "Fiji," is undoubtedly identical with the above. Some very large specimens, also from the same locality, may possibly belong to a different species, but the venation and markings are very similar.

Section III. LIMNOBINA ANOMALA.

"One sub-marginal cell; normal number of the antennal joints sixteen." (Osten-Sacken).

An artificial group, proposed by Baron Osten-Sacken, to include certain genera, the structural relation of which, one to another, is in many instances obscure, if not distant. The normal number of joints of the antennæ is sixteen, as in the ERIOPTERINA and LIMNOPHILINA; but the tibiæ are spurless and the wings possess

only a single sub-marginal cell, both characters of the LIMNOBINA. Again, unlike the latter some of these genera exhibit distinct empodia, whilst, on the other hand, some do not have them. In short, although these genera appear, and probably are, arbitrarily grouped together, they certainly cannot be admitted elsewhere; but in the present state of our knowledge the section is at least a convenient one.

Genus 7. RHAMPHIDIA, Meigen.

Leptorhina, Stephens, Catal. etc. 1829; *Megarhina*, St. Fargeau, Encycl. Meth. Ins. X., p. 585, 1825; *Helius*, St. Fargeau. l.c. Index, p. 831; *Rhamphidia*, Meig., Syst. Beschr. VI. p. 281, 1830; Macquart, S. à B. Dipt. I. p. 93, 1834; Walker, Ins. Brit. III. p. 308, 1856; Schiner, F. A., 1864; Osten-Sacken, Mon. Dipt. N. Amer. IV. p. 103, 1869; Studies II. p. 183, 1887.

"One sub-marginal cell; four posterior cells; a discal cell; no marginal cross-vein. The tip of the auxiliary vein is at some distance beyond the origin of the second vein; the sub-costal cross-vein is close at this tip. Rostrum elongated, but shorter than the thorax; last joint of the palpi elongated. Antennæ 16-jointed. Tibiæ without spurs at the tip; empodia indistinct; ungues smooth. The forceps of the male very like that of *Elephantomyia*." (Osten-Sacken).

The rostrum is much longer than the head in three out of the four species known to me; in *R. niveitarsis* only a little longer.

Only a few species of this genus are known, all, I believe, American and European. Four fossil species are stated by Loew to occur in Prussian amber (Bernst. und Bernstein fauna, 1850, p. 37).

312. RHAMPHIDIA COMMUNIS, sp.n. (Pl. XXI., fig. 9).

♂.—	Length of antennæ......	0·070 inch	...	1·77 millimètres.
	Expanse of wings........	0·380 × 0·090	...	9·64 × 2·27
	Size of body..............	0·340 × 0·050	...	8·62 × 1·27
♀.—	Length of antennæ......	0·060 inch	...	1·54 millimètres.
	Expanse of wings........	0·380 × 0·090	...	9·64 × 2·27
	Size of body..............	0·340 × 0·050	...	8·62 × 1·27

Head, including rostrum, palpi and antennæ, black; the rostrum $2\frac{1}{2}$-3 times the length of head. Thorax dark brown or fuscous, levigate, with four fulvous brown stripes; intermediate pair beginning at anterior border, coalescing at or a little before transverse suture and continuing to the scutellum; lateral ones broader, starting below the humeral pits, reaching a short distance beyond the suture, and opposite origin of wings; pectus, scutellum and posterior portion of metanotum sometimes more or less fulvous. Halteres yellow. Abdomen dark brown or fuscous, the segments bordered posteriorly with yellowish; genitalia brownish or yellowish-brown. Legs brown; femora becoming deep brown before tip; the tip of femora and extreme base of tibiæ yellow. Wings pellucid, with a pale brownish tint; veins, especially those enclosing discal cell, and the origin of præfurca, slightly clouded with brownish; yellow between costal and first longitudiual veins; veins and stigma dark fuscous; the later oblong. Auxiliary vein reaching costa a little before or opposite inner end of sub-marginal cell; sub-costal cross-vein at its tip, sometimes apparently obsolete; præfurca nearly straight; small cross-vein about half the length of the inner end of the second posterior cell; discal cell longer than broad, the great cross-vein at or a little beyond its inner end.

Hab.—Generally distributed in N.S.W.; September to April (Masters and Skuse).

Obs.—I have a series of about forty specimens for comparison. In some examples the light brown stripes on the thorax are very distinct, whilst in others the thorax is of a uniform dark brown with very faint or no traces of stripes.

313. Rhamphidia fulvithorax, sp.n.

♂.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·260 × 0·060	...	6·62 × 1·54
Size of body..............	0·240 × 0·030	...	6·09 × 0·76

Head greyish-brown; rostrum about the length of thorax, testaceous; palpi testaceous; antennæ dark brown. Thorax

fulvous or brownish-fulvous, levigate, without stripes; pectus and metathorax somewhat lighter. Halteres pale ochreous-yellow. Abdomen including genitalia brownish-fulvous, slightly infuscated. Legs light testaceous or brownish-ochreous, the femora pale at the tips preceded by a ring of brownish. Wings hyaline or almost so, slightly yellowish between first longitudinal vein and costa; veins testaceous-brown; stigma rather long, not very distinct, greyish. Auxiliary vein reaching costa at a point almost opposite inner end of sub-marginal cell; sub-costal cross-vein at its tip, appearing between it and first longitudinal vein; præfurca slightly arcuated at base; small cross-vein equal in length to inner end of second posterior cell; great cross-vein a little beyond inner end of discal cell.

Hab.—Narrabeen Lagoon, near Manly, N.S.W. (Skuse). One specimen in January.

314. Rhamphidia venusta, sp.n.

♂.—Length of antennæ.......	0·045 inch	...	1·13 millimètres.
Expanse of wings	0·290 × 0·060	...	7·35 × 1·54
Size of body	0.250 × 0·035	...	6·34 × 0·88
♀.—Length of antennæ	0·045 inch	...	1·13 millimètres.
Expanse of wings	0·290 × 0·060	...	7·35 × 1·54
Size of body..............	0.210 × 0·035	...	5·33 × 0·88

Head, including rostrum, palpi, and antennæ deep brown or blackish; the rostrum about twice the length of head. Thorax pruinose with pinkish- and yellowish-grey, with four deep brown velvety stripes, the intermediate pair beginning below the anterior margin and stopping before the transverse suture, the lateral ones broader, beginning below the humeri, reaching the scutellum and jutting triangularly opposite the origin of the wings; collare deep brown; mesonotum bordered by a deep brown broad line, usually sending back three small tooth-like offshoots, one at each humerus and a middle one (which sometimes meets the anterior extremity of the median longitudinal stripes); pleuræ with a

dark brown stripe; pectus and metanotum usually dark brown. Halteres pale yellow. Abdomen dark fuscous-brown; ♀ ovipositor ochraceous. Coxæ and femora yellowish-brown, sometimes darker; base of coxæ, the trochanters, and a broad ring at tip of femora, dark brown; tibiæ and tarsi greyish-brownish, more or less infuscated. Wings somewhat tinged; all the veins slightly clouded with greyish; a more or less distinct cloud at base of præfurca, sometimes another connecting stigma with discal cell, and less frequently a third at inner end of discal cell; stigma dark fuscous; veins cinereous, the costal and first longitudinal veins yellowish. Auxiliary veins reaching costa at a point a little before inner end of sub-marginal cell; sub-costal cross-vein at its tip, connecting it with first longitudinal vein; præfurca angularly bent near its origin, sometimes with a small tooth of a vein at the angle; small cross-vein shorter than inner end of second posterior cell; inner end of discal cell considerably larger than outer end, opposite tip of sixth longitudinal vein, and forming an angle much less than a right angle; great cross-vein situated a little beyond inner end of discal cell.

Hab.—Knapsack Gully, Blue Mountains; Clifton; and Middle Harbour, near Sydney (Skuse). Four specimens.

Obs.—In one specimen (in one wing only) a supernumerary cross-vein exists in the first basal cell, joining the second longitudinal vein near its origin.

315. Rhamphidia niveitarsis, sp.n.

♀.—Length of antennæ......	0·047 inch	...	1·18 millimètres.
Expanse of wings,.......	0·270 × 0·057	...	6·85 × 1·44
Size of body..............	0·270 × 0·003	...	6·85 × 0·76

Head greyish-brown; rostrum a little longer than the head, basal portion ochreous, the tip brown; palpi brown; antennæ brown, the first joint of scapus usually ochreous. Collare tinged with brown. Thorax ochreous-brown (darker on mesonotum), somewhat shining; pleuræ ochreous, more or less hoary. Halteres infuscated, the

base of stem pale ochreous. Abdomen brown; venter more or less ochreous; ovipositor rather long, slightly curved, brown. Coxæ ochreous; trochanters very slightly tinged with blackish at tip; femora brown, white at tip; tibiæ brown with a slight ring at base, and a third of their length at distal end, white; tarsi entirely white. Wings hyaline, with brilliant purplish and golden reflections; veins brown; stigma pale, slightly tinted with brownish. Auxiliary vein reaching costa opposite or somewhat beyond inner end of first posterior cell; sub-costal cross-vein near its tip, connecting it with the first longitudinal vein; præfurca short, slightly arcuated at its base; petiole of sub-marginal cell rather more than half the length of præfurca; small cross-vein nearly as long as the great cross-vein; third posterior cell more than three times broader at the tip than at its inner end, principally owing to the divergence of the posterior branch of the fourth vein; great cross-vein situated about middle of discal cell, the latter slightly angulated at that point.

Hab.—Knapsack Gully, Blue Mountains, and Woronora, N.S.W. (Masters and Skuse). Six specimens.

Genus 8. Orimarga, O.-Sacken.

Limnobia, Zetterstedt, Dipt. Scand. X. p. 389, 1851; *Orimarga*, O.-Sack., Mon. Dipt. N. Amer. IV. p. 120, tab. I. f. 9, 1869; *Ninguis*, Wallengren, Entom. Tidskr. Stockh. 1881 (on authority of Mik); *Orimarga*, O.-Sack., Studies II. p. 186, 1887.

"One sub-marginal cell; four posterior cells; discal cell open, coalescent with the second posterior cell; great cross-vein about the middle of the wing, and hence, the fourth posterior cell very long. Tibiæ without spurs at the tip; empodia distinct. Antennæ 16-jointed. Basal pieces of the male forceps elongated, slender, with horny, slender, claw-shaped appendages at the tip; upper valves of the ovipositor small, slender, pointed." (Osten-Sacken).

The following described are, as far as I can ascertain, the first species of this genus discovered out of Europe. Altogether only a few examples seem to be known.

316. ORIMARGA AUSTRALIS, sp.n. (Pl. XXI., fig. 10).

♂.—Length of antennæ......	0·042 inch	...	1·06 millimètres.
Expanse of wings........	0·250 × 0·042	...	6·34 × 1·06
Size of body..............	0·210 × 0·020	...	5·33 × 0·50
♀.—Length of antennæ......	0·042 inch	...	1·06 millimètres.
Expanse of wings..	0·270 × 0·045	...	6·85 × 1·13
Size of body..............	0·210 × 0·020	...	5·33 × 0·50

Head, rostrum, palpi and antennæ light reddish-brown; head hoary in a certain light; rostrum rather longer than the head. Thorax brownish-ochreous, hoary. Halteres pale. Abdomen brownish-ochreous to light reddish-brown; genitalia ferruginous. Legs uniformly pale yellowish-grey, apparently glabrous. Wings narrow, microscopically granulose, with a somewhat whitish appearance, non-iridescent; veins, like the membrane, colourless; stigma not visible. Auxiliary vein reaching costa opposite $\frac{2}{3}$ the length of præfurca; sub-costal cross-vein a little before tip of auxiliary vein; first longitudinal vein reaching costa at a point opposite tip of posterior branch of fourth longitudinal, and at $\frac{2}{3}$ the distance from tip of auxiliary vein to apex of wing; second longitudinal originating at about middle of the length of wing, angularly bent near its origin, then running almost straight; præfurca $\frac{2}{3}$ the length of sub-marginal cell; marginal cross-vein opposite small cross-vein, and at a point $\frac{1}{3}$ the distance from inner end of sub-marginal cell to tip of first longitudinal vein; veins inclosing first posterior cell almost parallel, slightly convergent towards their tips; inner end of second posterior cell a little before small cross-vein; great cross-vein a little oblique, situated at a point mid-way between origin of second longitudinal vein and inner end of submarginal cell; sixth longitudinal vein converging towards fifth longitudinal vein at the tip.

Hab.—Middle Harbour, near Sydney (Skuse). Three specimens.

Obs.—The alar venation of this species chiefly differs from that of *O. alpina*, Zett., figured by Baron O.-Sacken (Mon. Dipt. N.

Amer. IV. pl. I. f. 9), in having the marginal cross-vein more remote from the tip of first longitudinal vein, and the great cross-vein not quite so near the middle of the wing.

317. Orimarga inornata, sp.n.

♀.—Length of antennæ	0·040 inch	...	1·01 millimètres.
Expanse of wings.........	0·200 × 0·040	...	5·08 × 1·01
Size of body..............	0·190 × 0·020	...	4·81 × 0·50

Head, including rostrum, palpi and antennæ, black; head hoary; rostrum about the length of the head. Thorax black, hoary. Halteres pale yellowish, the club somewhat infuscated. Abdomen deep fuscous-brown, somewhat shining; ovipositor ochreous-brown. Legs yellowish-brown; tarsi darker. Wings narrow, microscopically granulose, with a somewhat whitish appearance, weakly iridescent; veins pale; stigma not visible. Auxiliary vein reaching costa opposite a point somewhat before ½ the length of præfurca; sub-costal cross-vein at tip of auxiliary vein; first longitudinal vein reaching costa opposite a point somewhat before tip of posterior branch of fourth longitudinal, and at ⅔ the distance from tip of auxiliary vein to apex of wing; second longitudinal vein originating at about middle of the length of wing; præfurca moderately arcuated near its origin, nearly ⅔ the length of sub-marginal cell; marginal cross-vein in advance of small cross-vein a distance equal to its length, and at a point mid-way between inner end of sub-marginal cell and tip of first longitudinal vein; marginal and small cross-veins equal in length; veins inclosing first posterior cell considerably convergent towards their tips; inner end of second posterior cell a little before small cross-vein; great cross-vein a little oblique, situated about mid-way between origin of second longitudinal vein and inner end of sub-marginal cell; sixth longitudinal vein converging towards fifth longitudinal at the tip.

Hab.—Clifton, Illawarra District (Skuse). One specimen in December.

Obs.—The great cross-vein is situated in very much the same position as in *O. australis ;* the marginal cross-vein as in *O. alpina,* Zett. In one wing there is a supernumerary cross-vein near the base of the second posterior cell, thus inclosing a small square cell.

Genus 9. LEIPONEURA, gen. nov.

One sub-marginal cell; four posterior cells; discal cell sub-triangular; *no marginal cross-vein*; tip of auxiliary vein before or beyond the origin of second longitudinal vein; the sub-costal cross-vein at or a little before the tip of the auxiliary vein; third longitudinal vein considerably arcuated, joining margin close to tip of anterior branch of fourth longitudinal. Antennæ 16-jointed, short. Tibiæ without spurs at the tip; empodia distinct; ungues smooth.

Rostrum short, about half the length of the head. Palpi short, the first and last joints of equal length, and about equal to the second and third taken together (Pl. XXIV., fig. 53, palpi of *L. brevivena*). Antennæ short, if bent back would not reach the root of the wings; joints of the scapus of equal length, sub-cylindrical; joints of the flagellum elongate, with a minute pubescence and beset with short hairs: in *L. brevivena* the first two or three flagellar joints are sub-globose (Pl. XXIV., fig. 54). Eyes glabrous; front rather narrow. Collare short. The thorax with distinct shining humeral pits; transverse suture distinct. Upper valves of the ovipositor rather long, slender, pointed, curved upwards towards the extremity. Legs moderately long, slender, the femora incrassated at the tip; ungues very small, smooth. Wings rather long and narrow, with a semi-diaphanous appearance, and a weak iridescence; the pubescence on their surface extremely microscopic, as in *Antocha.** Anal angle of wings inconspicuous. Veins with a minute pubescence. Stigma long, indistinct. The tip of the auxiliary vein reaches beyond the origin of the second longitudinal vein in *L. gracilis,* a distance about twice the length of the great

* I could discover only minute dots with a $\frac{1}{4}$ in. objective.

cross-vein, but in *L. brevivena* it joins the costa about a similar distance before the origin; this is on account of the difference in the length and character of the præfurca, which in the first-named species originates at an acute angle about the middle of the length of the wing, but in a rounded angle considerably beyond the middle in *brevivena*. Marginal cross-vein wanting. Second longitudinal vein gently bending upwards to the margin; third longitudinal vein arcuated downwards, reaching the margin close to the tip of the anterior branch of the fourth longitudinal; so that the sub-marginal cell is enormously widened, and the first posterior cell extremely narrowed, at the wing-margin.

The sub-marginal cell is very little longer than the first posterior; the small or anterior cross-vein is arcuated and unusually long, being quite the length of the great cross-vein; consequently the inner end of the discal cell is very short, which causes the cell to be almost triangular; great cross-vein at, or a little before, the inner end of the discal cell; fifth and sixth longitudinal veins nearly straight; the seventh very slightly arcuated.

This genus appears to be somewhat related to *Antocha*, O.-Sack., on the one hand, and *Artarba*, O.-Sack., on the other; to the former in wanting the cross-vein, to the latter by the extremely microscopic pubescence of the wings, but in other particulars it seems to entirely differ. Unfortunately, not having a single male specimen, I cannot describe the holding-forceps. Both the following described have their pleuræ conspicuously striped with yellow and brown.

318. Leiponeura gracilis, sp.n. (Pl. xxi., fig. 11).

♀.—Length of antennæ......	0·047 inch	...	1·18 millimètres.
Expanse of wings........	0·240 × 0·050	...	6·09 × 1·27
Size of body..............	0·210 × 0·025	...	5·33 × 0·62

Head, including rostrum, palpi and antennæ, black, the front with a hoary bloom; sometimes the face and rostrum yellow. Thorax brown, opaque, with two small yellow spots behind the

suture in the middle, and one on each side above the origin of the wings; bordered laterally and in front by a narrow yellow stripe, followed on the pleuræ by three longitudinal stripes, brown and yellow alternately; scutellum yellow, somewhat tinged with brown anteriorly; metanotum deep brown. Halteres yellow. Abdomen brown, sometimes deep brown; venter and ovipositor usually pale ochreous-yellow. Legs light umber-brown, the terminal tarsal joints blackish. Wings slightly tinged with brownish-grey or very pale brownish; veins light umber-brown; stigma colourless or just perceptibly brownish, elongate, narrow, stretching almost the entire length of the ultimate section of the second longitudinal Auxiliary vein reaching costa considerably beyond origin of second longitudinal, usually a distance equal to about twice the length of great cross-vein; sub-costal cross-vein a little before the tip of auxiliary vein, sometimes even a distance equal to length of great cross-vein; præfurca equal in length to the continuation of the vein, originating at an acute angle; discal cell about half the length of second posterior cell; great cross-vein situated somewhat before its inner end.

Hab.—Knapsack Gully, Blue Mts., and Sydney, N.S.W. (Masters and Skuse.) Five specimens in September.

319. Leiponeura brevivena, sp.n.

♀.—Length of antennæ......	0·037 inch	...	0·90 millimètre.
Expanse of wings........	0·180 × 0·045	...	4·56 × 1·13
Size of body..............	0·150 × 0.020	...	3·81 × 0·50

Head, including rostrum, palpi and antennæ dark brown or black, the joints of the scapus ochraceous or light ferruginous. Thorax similarly coloured to that of *L. gracilis*; the first lateral yellow stripe, however, is much broader in this species, and the following brown one a mere line; and the yellow spots in front of the scutellum are indistinct. Halteres pale. Abdomen brown, each segment very slightly bordered posteriorly with

yellow; venter and ovipositor ochraceous-yellow. Legs pale brownish-ochreous. Wings with a delicate brownish tint, the stigma and extremity of first sub-marginal cell tinted somewhat darker; veins light brown; stigma not twice the length of great cross-vein. Auxiliary vein reaching costa before origin of second longitudinal vein a distance equal to the length of great cross-vein; sub-costal vein at tip of auxiliary vein; præfurca much arcuated near its base, originating considerably beyond the middle of the wing, shorter than the rest of the vein; discal cell nearly as long as the second posterior cell, its inner end almost an angle; great cross-vein situated a little before the inner end.

Hab.—Berowra, N.S.W. (Skuse). Two specimens in August.

Genus 10. Teucholabis, Osten-Sacken.

Teucholabis, O.-Sack., Proc. Ac. Nat. Soc. Philad. p. 223, 1859; Mon. Dipt. N. Amer. IV. p. 129, pl. I. fig. 12 (wing), pl. III. fig. 9 (genitalia), 1869; Studies, II. 188, 1887.

"One sub-marginal cell; four posterior cells; a discal cell; *first longitudinal vein very short*, its tip being but little beyond the middle of the length of the wing, nearly opposite or not much beyond the inner end of the sub-marginal cell. Wings very hyaline, stigma rounded. Antennæ 16-jointed. Rostrum cylindrical, distinctly prolonged, although shorter than the head. *Collare prolonged in a narrow linear neck.* Feet rather stout, hairy; tibiæ without spurs at the tip; empodia distinct, but small. Genitals of the male hairy on the outside; forceps with large, horny appendages and an anal style." (Osten-Sacken).

This genus also occurs in North and South America, Southern Asia and New Guinea; only a small number of species are known.

320. Teucholabis meridiana, sp.n.

♂.—Length of antenn	0·055 inch	...	1.39 millimètres.
Expanse of wings........	0·240 × 0·090	...	6·09 × 2·27
Size of body	0·230 × 0·035	...	5·84 × 0·88

Head dark brown, hoary on the front. Rostrum about the length of the head, ochraceous; palpi and antennæ dark brown, the basal joints of the latter tinged with ochraceous, the flagellar joints gradually diminishing in size, large and globose at the base, becoming slender and oblong towards the tip. Thorax brownish-ochraceous, shining, with three deep brown or black stripes; intermediate one beginning at collare; lateral ones much broadened anteriorly, completely interrupted at transverse suture, with a yellow spot at their posteriorly extremity above the origin of the wings; scutellum yellow; metanotum deep brown, bordered with yellow at the sides; pleuræ ochraceous-yellow, with a dark brown stripe from humeri to pectus. Halteres yellow. Abdomen brown, anterior half of the segments brownish-ochraceous; forceps brown. Coxæ and femora ochraceous, the latter brown at the tip; tibiæ and tarsi brown. Wings almost hyaline, the cross-veins and apical margin of wing slightly infuscated with brownish, and the costal and sub-costal cells tinted with yellowish; costal, auxiliary and first longitudinal veins ochraceous, the rest brown; stigma rather small, brown. The venation exactly like that of *T. complexa*, O.-Sack., (Mon. Dipt. N. Amer. IV. pl. I. fig. 12), except that the sub-costal cell is a little expanded near the stigma, the third longitudinal vein and anterior branch of the fourth longitudinal run almost straight to the margin, the sixth longitudinal vein is a little sinuated at the tip, and that of the seventh considerably arcuated. Great cross-vein situated beyond small cross-vein, and about opposite tip of first longitudinal vein.

Hab.—Victoria. *Type-specimen in Coll. Australian Museum.*

Obs.—Very closely related to *Teucholabis complexa*, O.-Sack., from North America.

Section III. ERIOPTERINA.

" *Two sub-marginal cells;* four (very seldom five) posterior cells; discal cell sometimes closed, but very often open. Normal number of the antennal joints sixteen. Eyes glabrous. *Tibiæ without spurs at the tip;* empodia distinct; ungues smooth on the under side." (Osten-Sacken.)

Rather more than a dozen genera, chiefly American and European, are referred to this section; a few of them doubtfully. Some of them, as remarked by Baron Osten-Sacken, seem to exhibit the aspect of the LIMNOPHILINA. *Conosia* is one of these puzzling genera. Outside of America and Europe very little has been done amongst the ERIOPTERINA. Dr. E. Bergroth has recently described about half a dozen species from South Africa, for one species of which he erects the new genus *Podoneura;* only three species have hitherto been recorded from Australia, two belonging to the genus *Trimicra*, and one to *Gnophomyia*.

Genus 11. RHYPHOLOPHUS, Kolenati.

Rhypholophus, Kolenati, Wiener Entom. Mon. p. 393, 1863; O.-Sacken, Mon. Dipt. N. Amer. IV. p. 139, pl. I. figs. 14 and 15, 1869; Studies, II. p. 192, 1887.

"Two sub-marginal cells; four posterior cells; discal cell present or absent. *Wings pubescent on the whole surface.* The second longitudinal vein originates at a more or less acute angle, before the middle of the anterior margin; the sub-costal cross-vein is a considerable distance (two or three lengths of the great cross-vein) anterior to the tip of the auxiliary vein. Antennæ 16-jointed. Tibiæ without spurs at the tip; ungues smooth on the underside; empodia distinct." (Osten-Sacken.)

Sub-genus, AMPHINEURUS, sub-gen. nov.

No discal cell. Posterior branch of fourth longitudinal vein forked; base of the fork (third posterior cell) situated at or a little before base of second posterior cell; the second and third posterior cells running almost to a point at the base. Second longitudinal vein arcuated or angulated at its origin, sometimes with even a short stump of a vein; the sub-costal cross-vein situated only a short distance beyond this origin.

In the main characters these insects appear to agree with *Rhypholophus*, but the peculiar modification of the second and third posterior cells, constant in both species, is a distinctive

characteristic, evidently of more importance than the mere absence of a discal cell under ordinary circumstances. They also apparently differ from the typical species of *Rhypholophus* in having the second longitudinal vein arcuated or even angulated at the base. It is unfortunate that all the specimens before me are females, as an examination of the male forceps would be interesting.

The hind femora are at least one-third longer than the intermediate pair, and distinctly wider than in either this or the fore pair. The third longitudinal vein, beyond the small cross-vein, is perfectly straight, and noticeably thicker than the other veins terminating at the apex of the wing. (Pl. XXI., fig. 12).

321. RHYPHOLOPHUS (AMPHINEURUS) UMBRATICUS, sp.n.

♀.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·260 × 0·080	...	6·62 × 2·02
Size of body	0·200 × 0·035	...	5·08 × 0·88

Head dark brown, clothed with golden-yellow hairs; palpi, rostrum, and antennæ brown, the first few joints of antennæ and last joint of palpi more or less ochreous. Thorax deep fuscous-brown, opaque, sparingly sprinkled with short hairs; lateral margin from humeri to base of wings tinged with ochreous; scutellum paler fuscous, or even ochreous-brown. Halteres ochreous with fuscous stem, the base more or less ochreous. Abdomen deep brown, clothed with yellow hairs; pectus and ovipositor ochreous-yellow or brownish-ochreous. Legs ochreous-brown to fuscous, terminal tarsal joints infuscated. Coxæ usually ochreous or brownish-ochreous. Wings pellucid (when denuded) tinged with brownish-yellow anteriorly and along the fifth longitudinal vein; densely covered with brown hairs, which appear darker (being thicker) at the tips of the auxiliary and first longitudinal veins and about the great cross-vein; veins pale brownish-ochreous. Auxiliary vein strong and distinct, reaching costa beyond marginal cross-vein a distance equal to the length of latter; sub-costal cross-vein situated a short distance beyond origin of

second longitudinal vein; first longitudinal pale at its tip; sub-costal cell very slightly expanded at tip of first longitudinal vein; petiole of first sub-marginal cell about twice the length of distance between origin of third longitudinal vein and small cross-vein; præfurca angularly bent near its origin, with a small stump of a vein; base of fork of posterior branch of fourth longitudinal vein situated a little before inner end of second posterior cell; great cross-vein joining fourth longitudinal vein a little before inner end of third posterior cell.

Hab.—Lawson, Blue Mountains, N.S.W.; January (Masters).

322. Rhypholophus (Amphineurus) maculosus, sp.n.

♀.—Length of antennæ......	0·040 inch	...	1·01 millimètres.
Expanse of wings	0·220 × 0·050	...	5·58 × 1·27
Size of body..............	0·180 × 0·020	...	4·56 × 0·50

Greyish-brown. Head somewhat sooty-brown, with short yellow hairs, palpi, rostrum, and antennæ brown; joints of flagellum sub-elliptic, with short hairs. Thorax opaque; pleuræ with two longitudinal narrow stripes of brown, the first from base of fore coxæ to base of halteres, the second above base of intermediate and hind coxæ. Halteres slightly yellowish at the base. Abdomen somewhat shining, clothed with short yellow hairs, the segments slightly ochreous laterally; ovipositor ochreous-brown, the upper valves curved. Coxæ and base of femora ochreous or greyish-ochreous; genua pale. Wings with a greyish tint; clothed with small alternate patches of pale yellow and blackish pubescence, giving the wing a somewhat indistinct spotted appearance; veins ochreous-yellow, the costal, and first, third, and fifth longitudinal veins most distinctly so. Auxiliary veins reaching costa at a point opposite marginal cross-vein; sub-costal cross-vein indistinct, situated a short distance beyond origin of second longitudinal vein; first longitudinal vein pale to its tip; marginal cross-vein at or a little beyond base of first sub-marginal cell; præfurca arcuated at its origin; petiole of first sub-marginal cell very short, as long or

a little longer than distance between origin of third longitudinal vein and small cross-vein; base of third posterior cell situated very slightly before that of second posterior; great cross-veins joining fourth longitudinal vein a short distance before inner end of third posterior cell.

Hab.—Mount Kosciusko, N.S.W., at 5000 ft.; March (Helms).

One specimen in Coll. Australian Museum.

Genus 12. MOLOPHILUS, Curtis.

Molophilus, Curtis, Brit. Ent. X. p. 444, 1833; O.-Sacken, Mon. Dipt. N. Amer. IV. p. 153, pl. I. fig. 19, 1869; Studies, II. p. 192, 1887.

"Two submarginal cells; four posterior cells; discal cell open. *Wings pubescent along the veins only.* Second longitudinal vein usually originates at a very acute angle, some distance before the middle of the anterior margin; subcostal cross-vein is at a considerable distance from the tip of the auxiliary vein; the *præfurca ends in the first submarginal cell,* which is longer than the second; the inner end of the discal cell (or rather, as it is always open, of the second posterior cell), as well as the great cross-vein, not in one line with the small cross-vein, but much nearer to the root of the wing. Antennæ 16-jointed. Tibiæ without spurs at the tip; ungues smooth on the under side; empodia distinct." (Osten-Sacken.)

I quite agree with Baron Osten-Sacken that this is a distinct genus. To the American, European, and New Zealand species already recorded, I now add fourteen species from Australia. It appears to be one of our best represented genera, both as regards species and individuals. Some species are very numerous.

The venation seems to be very much the same in all the following species, not exhibiting any noticeable specific characters; the hairy clothing of the veins, however, differs in length and density. *Molophilus longicornis* is remarkable in possessing very long antennæ.

The tibiæ of the males in some, if not the majority, of species exhibit a sexual character which does not appear to have been noted, or recorded, by previous authors. This is an annular swelling or nodosity, hardly perceptible in some instances but often prominent and dark-coloured, situated close to the base of the fore tibiæ. It would seem that North American species do not have this, since Baron Osten-Sacken does not allude to it in his monograph and being present it could scarcely have escaped his notice.

323. Molophilus ruficollis, sp.n.

♂.—Length of antennæ......	0·070* inch	...	1.77 millimètres.
Expanse of wings........	0·220 × 0·065	...	5·58 × 1·66
Size of body..............	0·170 × 0·035	...	4·31 × 0·88
♀.—Length of antennæ	0·070 inch	...	1·77 millimètres.
Expanse of wings........	0·220 × 0·065	...	5·58 × 1·66
Size of body..............	0·180 × 0·035	...	4·56 × 0·88

Head, including rostrum, palpi, and antennæ dark brown; flagellar joints sub-cylindrical, somewhat fusiform, densely and uniformly verticillate-pilose; collare with long golden hairs. Thorax reddish-brown, levigate, with two longitudinal rows of brown hairs; humeri with an ochreous spot; a patch of long yellow hairs behind the origin of wings. Halteres light fulvous-brown with golden pubescence. Abdomen dusky brown, clothed with golden-yellow pubescence; male forceps reddish-brown; ovipositor short, curved, ochreous, or brownish-ochreous. Coxæ reddish-brown. Remaining joints dusky brown; the femora with a yellow ring a little before their tip (broader on the hind pair); hind femora stout. Wings sub-hyaline (when denuded); somewhat clouded in the vicinity of bases of sub-marginal cells; the veins brownish, with dense long hairs, covering the cells; the

* The stated length of the antennæ in this and some of the following small insects is only approximate, owing to their being sometimes very difficult to measure.

hairs dusky brown, with a dull somewhat cupreous reflection; more dense and forming a transverse somewhat indistinct clouding between tip of auxiliary vein and base of first posterior cell, also on great cross-vein and basal portion of posterior branch of fourth longitudinal vein.

Hab. — Lawson, Blue Mountains, N.S.W. (Masters). Six specimens in January.

324. Molophilus femoratus, sp.n.

♀.—Length of antennæ.. ...	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0.180 × 0·050	...	4·56 × 1·27
Size of body..	0·125 × 0·023	...	3·16 × 0·58

Head, including rostrum and palpi, dark brown, densely covered with brown hairs; antennæ more ochreous-brown, with long, dense, brown verticils; flagellar joints almost fusiform. Thorax greyish-brown, levigate; humeri slightly tinged with ochreous; pleuræ and metathorax reddish-brown. Halteres greyish-brown, the base of stem ochreous. Abdomen dark, somewhat reddish-brown, clothed with tolerably long, yellowish hairs; ovipositor short, curved, brownish-ochreous. Coxæ testaceous or brownish-ochreous. Remaining joints dark brown; all the femora with a broad ring of fulvous much (twice its length) before their tips; the hind femora very stout. Wings sub-hyaline (when denuded); veins pale, densely beset with long brownish hairs; the latter rather more dense and forming an indistinct narrow transverse clouding from tip of auxiliary vein to base of first posterior cell.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). January.

Obs.—I have only a single specimen before me.

325. Molophilus Helmsi, sp.n.

♂.—Length of antennæ......	— inch	...	— millimètres.
Expanse of wings.........	0·250 × 0·065	...	6 34 × 1·66
Size of body	0·180 × 0·037	...	4·56 × 0·90

♀.—Length of antennæ.......	0 060 inch	...	1·54 millimètres.
Expanse of wings.	0·270 × 0·070	...	6·85 × 1·77
Size of body..............	0·185 × 0·040	...	4·68 × 1·01

Dusky brown. Head, including rostrum, palpi, and antennæ black or deep brown; joints of the flagellum fusiform, with some long verticillate hairs. Thorax levigate, with two longitudinal rows of golden hairs; humeri tinged with ochreous-yellow. Halteres with a dense pale yellowish sericeous pubescence, the base of stem brown. Abdomen clothed with golden-yellow hairs; male forceps black; ovipositor ochreous, the lower valve brown. Legs entirely dusky or sooty brown. Wings sub-hyaline, the veins yellowish, with dense long hairs covering the cells; the hairs chiefly dusky brown, with some golden patches; an elongate patch of golden hairs on costa immediately beyond the tip of auxiliary vein; that portion of first longitudinal vein before the costal patch, the third longitudinal vein except at its base and towards its extremity, portions of veins in the middle of the wing, and fifth, sixth and seventh longitudinal veins, with golden hairs; marginal cilia dusky brown variegated with golden.

Hab.—Mount Kosciusko, N.S.W., at 5000 ft.; March (Helms).

Two specimens in Coll. Australian Museum.

326. Molophilus notatipennis, sp.n.

♀.—Length of antennæ......	0·050 inch	...	1·27 millimètres
Expanse of wings........	0·220 × 0·050	...	5·58 × 1·27
Size of body..............	0·140 × 0·025	...	3·55 × 0·62

Head, including rostrum, palpi, and antennæ, dark brown; flagellar joints subcylindrical, rather larger towards their base, verticillate-pilose. Thorax reddish-brown, levigate, with two sparse longitudinal rows of brown hairs; humeri, base of wings and centre of transverse suture ochre-yellow. Halteres pale yellow, with a sericeous pubescence. Abdomen dusky or deep umber-brown, clothed with yellow hairs; ovipositor brownish-ochreous,

valves very short. Coxæ ochreous. Remaining joints dusky brown, the knees pale yellow or whitish. Wings sub-hyaline (when denuded); the veins pale brownish, with dense long hairs covering the cells; hairs brown, more dense and forming five blackish clouds as follows:—first at the bases of the submarginal cells, second at the basal portion of posterior branch of fourth longitudinal fork, another at the middle of third longitudinal vein, another near base of fourth and fifth longitudinal veins, and the last beyond middle of seventh longitudinal vein.

Hab.—Gosford, N.S.W. (Skuse). One specimen in August. Taken flying about a tree-trunk.

327. Molophilus Froggatti, sp.n.

♀.—Length of antennæ......	0·090 inch	...	2·27 millimètres.
Expanse of wings........	0·290 × 0·080	...	7·35 × 2·02
Size of body..............	0·320 × 0·045	...	8·12 × 1·13

Head brown, pruinose with greyish; front with short black hairs; occiput with long golden-yellow hairs, rostrum, palpi, and antennæ black, the two basal joints of the latter brown; flagellar joints sub-cylindrical. Thorax light greyish-brown, dull, with three darker though indistinct brown stripes; intermediate stripe double; humeral pits and suture deep shining brown; pleuræ with a hoary bloom. Halteres pale ochreous-yellow. Abdomen brown, somewhat greyish, tolerably shining, clothed with brown hairs; venter ochreous-yellow; ovipositor rather long, curved, ferruginous. Legs obscure testaceous, densely clothed with hairs which exhibit a yellow reflection when viewed at a certain obliquity; tibiæ black at tip; apical half of first and whole of remaining joints of tarsi black. Wings with a light greyish-brown tint; veins yellowish-brown, densely and uniformly beset with long brown hairs. Second sub-marginal cell longer than the first posterior; inner end of third posterior cell opposite that of first sub-marginal cell; great cross-vein long and very oblique,

joining close to base of posterior branch of fourth longitudinal vein.

Hab.—Waverley, near Sydney; in October (Froggatt).

Obs.—I have seen only one specimen of this very distinct and comparatively large example of the genus.

328. Molophilus montivagus, sp.n.

♀.—Length of antennæ......	0·045 inch	...	1·13 millimètres.
Expanse of wings........	0·220 × 0·065	...	5·58 × 1·66
Size of body..............	0.180 × 0·035	...	4·56 × 0·88

Head greyish-brown, with a minute yellowish pubescence; rostrum, palpi and antennæ black or dark brown; flagellar joints elliptical, with short verticils. Collare ochreous. Thorax light ochreous-brown, almost covered by a very broad brownish median stripe; the whole pruinose with greyish; humeri slightly ochreous yellow; pleuræ dusky brown. Halteres very pale yellow, with a sericeous pubescence. Abdomen dusky brown, opaque, clothed with yellow hairs, the segments with an indistinct narrow border of dull ochreous-brown posteriorly; ovipositor testaceous. Coxæ dull testaceous. Remainder of joints uniformly dusky brown. Wings sub-hyaline; veins ochreous-yellow, sparingly beset with short grey hairs, imparting to the wings a light greyish appearance.

Hab.—Jindabyne, N.S.W., 3000 ft., March (Helms). *One specimen in Coll. Australian Museum.*

329. Molophilus gracilis, sp.n.

♂.—Length of antennæ......	0·070 inch	...	1·77 millimètres.
Expanse of wings........	0·220 × 0·055	...	5·58 × 1·39
Size of body..............	0·160 × 0·030	...	4·06 × 0·76
♀.—Length of antennæ......	0.055 inch	...	1·39 millimètres.
Expanse of wings........	0·220 × 0·055	...	5·58 × 1·39
Size of body..............	0·180 × 0·030	...	4·56 × 0·76

Head greyish or greyish-ochreous, the anterior portion of the front sometimes yellow; rostrum and palpi black or deep brown; antennæ brown, the basal joints ochreous; flagellar joints fusiform, with greyish verticils, longer in male. Collare yellow. Thorax greyish-ochreous or light greyish-brown, with a greyish bloom, sometimes with indistinct trace of a double median longitudinal stripe; humeri and a narrow lateral line to origin of wings yellow; metathorax and pleuræ brown to dark brown; scutellum ochreous, brownish or testaceous. Halteres yellow, sericeous. Abdomen brown or dusky brown, clothed with yellow hairs; forceps testaceous-brown, the horny appendages black; ovipositor long and straight, ochreous or testaceous. Legs testaceous or light ochreous-brown, with a greyish reflection; tibiæ and tarsi more or less distinctly infuscated; the tibiæ of the fore legs in the male with a black slightly swollen ring just beyond base. Wings sub-hyaline; veins yellowish or brownish, with long brownish hairs which impart a greyish appearance to the wings; a small indistinct clouding at the great cross-vein and base of posterior branch of fourth longitudinal fork, also a second smaller one often observable at marginal cross-vein.

Hab.—Apparently generally distributed in N.S.W. (Masters and Skuse). Almost throughout the year.

330. Molophilus annulipes, sp.n.

♂.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·180 × 0·050	...	4·56 × 1·27
Size of body	0·150 × 0·025	...	3·81 × 0·62
♀.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·190 × 0·050	...	4·81 × 1·27
Size of body..............	0·150 × 0·025	...	3·81 × 0·62

Fulvous-yellow or more ochreous. Rostrum and palpi dark brown; antennæ brownish; basal joints usually ochreous; flagellar joints fusiform. Thorax somewhat hoary laterally in a certain

light, traversed by two sparse longitudinal rows of brown hairs; an ill-defined brownish stripe in the pleuræ from neck to base of wings (not visible in some specimens); pleuræ, metathorax and abdomen light reddish-brown in some specimens; horny appendages of male forceps black; ovipositor of female concolorous with rest of body. Halteres yellow. Legs yellow, sericeous. Femora with two brownish or black rings (generally darker in the male) on apical half; the tibiæ of the fore legs in the male with a black slightly swollen ring just beyond the base; tips of tibiæ and of tarsal joints a little infuscated. Wings pellucid, with a yellow tint; veins yellow with long yellow hairs; a peculiar, very small, cuneate black marking between the auxiliary and first longitudinal veins immediately beyond the humeral cross-vein.

Hab.—Sydney, Blue Mountains, and Hogan's Brush near Gosford, N.S.W.; August to January (Masters and Skuse).

Obs.—Thirteen specimens for comparison.

331. Molophilus flavonotatus, sp.n.

♂.—Length of antennæ......	0·070 inch	...	1·77 millimètres.
Expanse of wings	0·180 × 0·047	...	4·56 × 1·18
Size of body..............	0·120 × 0·025	...	3·04 × 0·62

Head brown, tinged with yellow, with white pubescence; rostrum and palpi black; antennæ greyish, the basal joints ochreous; flagellar joints fusiform, with white verticils. Collare sulphur-yellow, somewhat tinged with brownish. Thorax rich brown, the humeral region and lateral borders sulphur-yellow; a spot on each side above the origin of wings, the scutellum, lateral borders of metanotum and origin of wings brownish-testaceous or ochreous. Halteres pale with sericeous white pubescence. Abdomen somewhat ochreous-brown, clothed with white hairs; forceps brownish-testaceous, the tips of the horny appendages black. Coxæ brownish-testaceous or ochreous. Remaining joints greyish, their tips a little infuscated; tibiæ of the fore legs with a slightly

swollen scarcely infuscated ring near the base. Wings almost hyaline; veins and hairs pale, the latter not dense but tolerably long; a small and rather indistinct linear brown marking between the auxiliary and first longitudinal veins, immediately beyond the humeral cross-vein.

Hab.—Sydney, September (Skuse).

332. Molophilus translucens, sp.n.

♂.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·150 × 0·047	...	3·81 × 1·18
Size of body..............	0·115 × 0·020	...	2·92 × 0·50
♀.—Length of antennæ......	0·047 inch	...	1·18 millimètres.
Expanse of wings........	0·150 × 0·047	...	3·81 × 1·18
Size of body..............	0·120 × 0·020	...	3·04 × 0·50

Entirely pale yellow or ochreous; the rostrum, palpi and two basal joints of antennæ sometimes brown or brownish; flagellar joints fusiform, with pale verticils. Body and legs distinctly haired in ♂; horny appendages of male forceps black; ovipositor rather short, curved, concolorous with rest of body. Wings hyaline or nearly so, with delicate opaline iridescence; veins pale, beset with long, very pale yellow, hairs.

Hab.—Lawson, Blue Mts. (Masters); Gosford and Hogan's Brush, Narrara Creek, N.S.W.; August to January (Skuse).

333. Molophilus canus, sp.n.

♂.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings..... ..	0·190 × 0·042	...	4·81 × 1·06
Size of body........	0·150 × 0·025	...	3·81 × 0·62

Head light brown, hoary, with white hairs; rostrum and palpi dark brown, antennæ brown, the basal joints more or less ochreous; flagellar joints fusiform, with white verticils. Thorax light greyish-brown, dull, with a very small transverse brown spot on each side

behind the humeri; pleuræ somewhat hoary; a small tuft of white hairs behind the origin of the wings; origin of wings ochreous-yellow. Halteres yellow. Abdomen brown, clothed with white hairs; forceps brownish-ochreous, the tips of horny appendages black. Coxæ ochreous. Remaining joints greyish, with a brownish tinge, somewhat sericeous, slightly infuscated towards their tips; tibiæ of the fore legs with an indistinct slightly swollen infuscated ring near their base. Wings almost hyaline; veins pale yellowish, rather sparingly beset with long pale hairs, imparting a pale greyish appearance to the wings.

Hab.—Sydney (Skuse). August and September.

334. Molophilus pulchripes, sp.n.

♂.—Length of antennæ......	0·060 inch	...	1·54 millimètres.
Expanse of wings.........	0·160 × 0·050	...	4·06 × 1.27
Size of body..............	0·130 × 0·020	...	3·30 × 0·50

Head browu, bordered above the eyes with yellow; rostrum, palpi and antennæ brown; basal joints of antennæ yellowish; flagellar joints fusiform; collare yellow or yellowish. Thorax brown, dull, with two longitudinal rows of short brown hairs; humeri, lateral line to origin of wings, transverse suture, a small spot above the origin of wings, scutellum, and lateral borders of metanotum yellow or yellowish. Halteres yellow. Abdomen brown, clothed with yellow hairs; forceps brown, rather lighter than abdominal segments, the horny appendages black. Legs yellowish-brown; femora tipped with brown preceded by a broader ring of golden-yellow; genua yellow; tibiæ and joints of tarsi slightly infuscated at the tips; tibiæ of fore legs with a slightly swollen brown ring near the base. Wings almost hyaline; veins pale-yellowish, moderately clothed with brownish hair, imparting a greyish appearance to the wings; the hairs more dense, longer and perhaps darker, forming an oblique clouding, from tip of auxiliary vein to great cross-vein.

Hab.—Sydney (Skuse). September.

335. Molophilus pervagatus, sp.n.

♂.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·150 × 0·042	...	3·81 × 1·06
Size of body........... ..	0·120 × 0·020	...	3·04 × 0·50
♀.—Length of antennæ......	0·042 inch	...	1·06 millimètres.
Expanse of wings.	0·150 × 0·042	...	3·81 × 1·06
Size of body..............	0·135 × 0·020	...	3·42 × 0·50

Head brown, sometimes bordered with yellow or yellowish; rostrum and palpi brown; antennæ brown; the first basal joint yellow; flagellar joints fusiform or sub-cylindrical. Collare yellowish. Thorax light brown, with an ochreous or sometimes a reddish tendency, dull, with two longitudinal rows of brown hairs; humeri and lateral line to origin of wings ochreous-yellow; pleuræ and metathorax dark brown; origin of wings yellowish. Halteres yellow. Abdomen dark brown, clothed with yellow hairs; male forceps and female ovipositor testaceous-brown. Legs ochreous, brownish-yellow or sometimes yellowish-grey, with a sericeous, almost golden-yellow reflection; femora with a brown ring at the tip; fore tibiæ of male with slightly swollen brown ring near the base. Wings hyaline or almost so; veins pale yellowish, clothed with long brownish hairs, imparting a grey appearance to the wings; the hairs, more dense, longer, rather darker, and forming a more or less distinct oblique clouding between the tip of auxiliary vein and great cross-vein, as in *M. pulchripes*.

Hab.—Generally distributed in N.S.W. (Masters and Skuse). Almost throughout the year.

Obs.—This is probably the most common of our species.

336. Molophilus lucidipennis, sp.n.

♂.—Length of antennæ......	0·033 inch	...	0·84 millimètre
Expanse of wings..	0·150 × 0·042	...	3·81 × 1·06
Size of body..............	0·120 × 0·020	...	3·04 × 0·50

♀.—Length of antennæ......	0·042 inch	...	1·06 millimètres.
Expanse of wings........	0·150 × 0·042	...	3·81 × 1·06
Size of body..............	0·135 × 0·020	...	3·42 × 0·50

Brown. Thorax dull, with two longitudinal rows of brownish hairs. Halteres testaceous or brownish-ochreous. Abdomen clothed with golden-yellow hairs; anal forceps and female ovipositor testaceous or dull ochreous-brown. Legs light brown, testaceous or brownish-ochreous; tarsi somewhat infuscated with greyish; the tibiæ of fore legs in male with an indistinctly swollen brownish ring near their base. Wings hyaline; veins very pale yellowish, beset with long brownish-yellow hairs, imparting a uniform light greyish appearance to the wings.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). January.

337. Molophilus longicornis, sp.n.

♂.—Length of antennæ......	0·120 inch	...	3·04 millimètres.
Expanse of wings........	0.170 × 0·040	...	4·31 × 1·01
Size of body..............	0·115 × 0·020	...	2·92 × 0·50
♀.—Length of antennæ......	0·065 inch	...	1·66 millimètres.
Expanse of wings........	0·170 × 0·040	...	4·31 × 1·01
Size of body..............	0·130 × 0·020	...	3·30 × 0·50

Head, brownish, more or less tinged with yellow; rostrum and palpi brown; antennæ brown (the basal joints in male yellow), in the male the length of body, in female about half the length; flagellar joints cylindrical, with short pedicels; with long verticils in male. Thorax light, somewhat reddish-brown, levigate, with a more or less distinct median ochreous-yellow stripe extending from collare to posterior border of metanotum; the anterior portion of stripe, and also that traversing the metanotum, narrow, the rest as broad as scutellum; sternum and coxæ ochreous-yellow. Halteres brown, the extreme base of stem yellowish. Abdomen brown, clothed with yellow or brownish hairs; genitalia brownish-ochreous

or testaceous. Legs ochreous-yellow; the terminal joints of tarsi almost imperceptibly infuscated. Wings almost hyaline (when denuded); veins brownish, densely beset with long brown hairs.

Hab.—Berowra, N.S.W. (Masters); Knapsack Gully, Blue Mountains, N.S.W. (Skuse). August.

Obs.—One specimen only was captured in each locality. The specimens appear undoubtedly the two sexes of the same species.

Genus 13. Tasiocera, gen.nov.

Two sub-marginal cells; four posterior cells; discal cell present or absent. Wings very cuneiformly narrowed towards the base, *pubescent along the veins only.* Second longitudinal vein originates at an acute angle some distance before the middle of the anterior margin; sub-costal cross-vein very indistinct or none; *præfurca ends in the second sub-marginal cell,* which is longer than the first; inner end of discal cell, and great cross-vein, not in one line with the small cross-vein but much nearer to root of the wing (as in *Molophilus*). *Seventh longitudinal vein very short.* Antennæ 16-jointed, *about twice the length of the entire body.* Tibiæ without spurs at the tip; ungues smooth on the under side; empodia distinct. Male forceps very hairy at the apex of the fleshy lobe, terminated with horny appendages, toothed at the extremity (Pl. xxiv., fig. 55).

The rostrum and palpi short. The antennæ with one or more very long cylindrical joints at the base of flagellum, the remainder becoming more flasked-shaped, the terminal joint very small, more or less ovate; adorned with long verticillate hairs. The two joints of the scapus are small, globose, or more cupuliform, equal in size. In *T. gracilicornis* (Pl. xxiv., fig. 56) the flagellar joints more quickly begin to appear flask-shaped, only the first joint being cylindrical; on this account the antennæ are shorter than those of *T. tenuicornis.* The first cylindrical joints and the basal portions of all the following joints are about equal in width; if anything, the flask-shaped joints are slightly broader at their widest part

than the thickness of the cylindrical ones. The verticils are not stiff, but appear slightly crimpled. Legs long and very slender (in *T. gracilicornis* two and a-half times the length of the wings); the intermediate pair very little shorter than the other pairs.

Wings narrow, very cuneiformly so towards their base, fringed with long cilia on the posterior border; the hairs on the veins long enough to reach from vein to vein, causing the wings to appear very hairy. Auxiliary vein very short in *T. tenuicornis*, extending only to opposite the middle of the præfurca; while in *T. gracilicornis* it reaches beyond the marginal cross-vein; in both cases it seems to eventually amalgamate with and form a thickening of the costa. The sub-costal cross-vein seems entirely wanting; I could not detect it in wings denuded of hair and mounted in balsam. The discal cell when open coalesces with the third posterior cell, that is, the anterior branch of the fourth longitudinal vein is forked. The first bifurcation of the fourth longitudinal vein begins considerably before the small cross-vein, as in *Molophilus*. Second sub-marginal and first posterior cells about equal in length, their bases situated about as much before the inner end of first sub-marginal as that of the discal (or third posterior) cell is before theirs. The seventh longitudinal vein is straight and short, and runs close to the margin; in *T. tenuicornis* it so short that it ceases opposite the origin of the fourth longitudinal vein.

This genus seems intermediate between *Molophilus* and *Erioptera*, but differs from both especially by the antennæ. I have not seen any female examples, which may possible possess short antennæ.

338. Tasiocera tenuicornis, sp.n. (Pl. xxi., fig. 13).

♂.—Length of antennæ......	0·210 inch	...	5·33 millimètres.
Expanse of wings..	0·140 × 0·033	...	3·55 × 0·84
Size of body..............	0·110 × 0·016	...	2·79 × 0·40

Head, including palpi, rostrum and antennæ brown; palpi and joints of scapus sometimes pale brown, or greyish-ochreous; first four flagellar joints cylindrical, the first very long and twice the

length of the fourth; fifth to ninth joints rather rapidly diminishing in length and becoming more flask-shaped, terminal joint very small, shortly-ovate; all flagellar joints with long, fine, verticillate hairs, which in the flask-shaped joints are confined to their broad basal portion. Thorax brown, almost opaque; pleuræ, scutellum and metanotum sometimes lighter brown or greyish-testaceous. Halteres light brownish-grey. Abdomen brown, clothed with brown hairs; genitalia testaceous, densely haired. Legs sooty-brown, with a greyish-brown reflection in a certain light, the coxæ and base of femora greyish-testaceous or pale brown. Wings hyaline, the hairs along the veins long, brown; veins pale; cilia along the posterior margin very long. Auxiliary vein short, terminating in costa opposite middle of præfurca; marginal cross-vein pale, situated near base of first sub-marginal cell; base of latter situated beyond that of second sub-marginal a distance rather greater than length of great cross-vein; anterior branch of fourth longitudinal vein originating before inner end of first posterior cell a distance equal to once and a-half to twice the length of great cross vein; discal cell present (it is apparently the posterior branch which is forked, about the middle of its length); great cross-vein before, at, or beyond inner end of discal cell; sixth longitudinal vein a little arcuated at tip; seventh longitudinal vein very short, reaching posterior margin opposite origin of fourth longitudinal vein.

Hab.—Sydney and Woronora, N.S.W. (Masters and Skuse). Six specimens.

339. Tasiocera gracilicornis, sp.n.

♂.—Length of antennæ......	0·165 inch	...	4·18 millimètres.
Expanse of wings........	0·150 × 0·035	...	3·81 × 0·88
Size of body..............	0·100 × 0·016	...	2·54 × 0·40

Head, including palpi, rostrum and antennæ, brown, the basal joints of latter, also palpi and rostrum, sometimes more ochreous; first flagellar joint cylindrical, slightly narrowed at the apex, very

long, nearly three times the length of the second joint; following joints rapidly diminishing in length and becoming more perfectly flask-shaped, the terminal joints very small, ovate; all the flagellar joints with long fine verticillate hairs except on their narrowed anterior portion (Pl. xxiv., fig. 56). Thorax brown, very slightly shining; pleuræ and pectus sometimes paler. Halteres light brownish-grey, the base of stem ochreous. Abdomen dusky brown, clothed with brown hairs; genitalia testaceous-brown or darker, densely haired. Legs longer than in *P. tenuicornis*, sooty brown, greyish-brown when viewed in a certain light; the coxæ and extreme base of femora pale brown. Wings hyaline, the hairs along the veins long and brown; veins pale; cilia along the posterior margin very long. Auxiliary vein reaching the costa a short distance beyond marginal cross-vein; the latter near base of first sub-marginal cell; base of first sub-marginal cell obtuse, situated beyond that of the second sub-marginal a distance almost equal to length of great cross-vein; anterior branch of fourth longitudinal vein originating before the inner end of first posterior cell a distance equal to about twice the length of great cross-vein, forked considerably before its middle; discal cell usually open,* coalescent with the third posterior cell; great cross-vein opposite or a little beyond base of third posterior cell; sixth longitudinal vein arcuated at the tip; seventh straight, terminating in posterior margin opposite origin of præfurca.

Hab.—Sydney and Berowra, N.S.W. Five specimens (Masters and Skuse).

Obs.—Readily distinguished from the last by the character of the antennal joints.

Genus 14. Erioptera, Meigen,

Erioptera, Meig., Ill. Mag. II. p. 262, 1803; Syst. Beschr. I. p. 108, 1818; Macquart, S. à B. I. p. 109, 1834; Zetterstedt, F. Lapp. 1840; Dipt. Scand. X., 1851; Walker, Ins. Brit. III.,

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* I have found it closed in only one specimen.

p. 273, 1856; Schiner, F. A. Dipt. II., 1864; O.-Sacken, Proc. Acad. Nat. Sc. Philad. p. 225, 1859; Mon. Dipt. N. Amer. IV. p. 146, 1869; Studies, II. p. 193, 1887.

"Two sub-marginal cells; four posterior cells; discal cell present or absent. *Wings pubescent along the veins only.* The second longitudinal vein usually originates at a very acute angle, some distance before the middle of the anterior margin; the sub-costal cross-vein is at a considerable distance (two or three lengths of the great cross-vein, or more) from the tip of the auxiliary vein; the præfurca ends in the second sub-marginal cell, which is longer than the first. Antennæ 16-jointed. Tibiæ without spurs at the tip; ungues smooth on the underside; empodia distinct." (Osten-Sacken).

Sub-genus ERIOPTERA, O.-Sacken.

A. The "præfurca ends in the second sub-marginal cell, which is longer than the first; the inner end of the discal cell (or, when it is open, of the cell with which it coalesces) is on the same line with the small cross-vein.

1. The *posterior* branch of the fourth longitudinal vein is forked (in other words, when the discal cell is open, it coalesces with the *second* posterior cell; when it is closed, the inner end of the third posterior cell is nearer the basis of the wing than the inner end of the second).

   a. The seventh longitudinal vein is arcuated (converging towards the sixth) in such a manner, that the auxiliary cell is broader in the middle than near the margin of the wing." (Osten-Sacken).

340. ERIOPTERA OCHRACEA, sp.n.

♂.—Length of antennæ	0·030 inch	...	0.76 millimètres.
Expanse of wings	0·170 × 0·042	...	4·31 × 1·06
Size of body	0·135 × 0·020	...	3·42 × 0·50

♀.—Length of antennæ......	0·037 inch	...	0·90 millimètres.
Expanse of wings	0·170 × 0·042	...	4·31 × 1·06
Size of body.............	0·145 × 0·020	...	3.66 × 0·50

Dull brownish ochre-yellow. Palpi and antennæ sometimes brownish. Thorax opaque, sometimes with a very indistinct narrow median brownish stripe; two lateral longitudinal rows of short brown hairs. Halteres with a somewhat infuscated club. Abdomen dull, clothed with yellow hairs; superior segments more or less tinged with brown, with a narrow pale border posteriorly. Terminal joints of tarsi somewhat infuscated. Wings hyaline, microscopically granulose; veins ochreous-brown, the pubescence very short. Auxiliary veins reaching costa at a point a little before marginal cross-vein; discal cell open.

Hab.—Generally distributed in N.S.W. (Masters and Skuse). Almost throughout the year.

Obs.—The above-described answers in every particular to the characters of the sub-genus *Erioptera* as defined by Baron Osten-Sacken. It is the only Australian example as yet known to me.

Genus 15. Trimicra, O.-Sacken.

Trimicra, O.-Sacken, Proc. Ac. Nat. Sc. Philad. 1861, p. 290; Mon. Dipt. N. Amer. IV. p. 165, pl. II. fig. 1, 1869; Studies, II. p. 195, 1887.

"Two sub-marginal cells; four posterior cells; a discal cell; the second longitudinal vein originates at a more or less acute angle before the middle of the length of the wing and a considerable distance (more than the breadth of the wing) before the tip of the auxiliary vein; the sub-costal cross-vein is at a considerable distance (three lengths of the great cross-vein, or more) from the tip of the auxiliary vein; seventh longitudinal vein straight. Wings and their veins glabrous. Antennæ 16-jointed; *three last joints of the flagellum abruptly smaller*. Tibiæ without spurs at tip; ungues small, smooth on the underside, inserted under a projection of the last tarsal joint; empodia small,

but distinct. Forceps of the male with large, incrassated basal pieces, and a double claw-shaped horny appendage fastened to them on each side; ovipositor with flattened, curved, pointed upper valves and short lower ones." (Osten-Sacken).

341. Trimicra hirtipes, Walker.

Limnobia hirtipes (♂), Wlk., List Dipt. Brit. Mus. I. p. 50, 1848; *Trimicra Sydneyensis* (♀), Schiner, "Novara" Exp. Dipt. p. 43, 1868; *Trimicra hirtipes*, O.-Sacken, Mon. Dipt. N. Amer. IV. p. 167, 1869.

♂.—Length of antennæ......	0·085 inch	...	2·14 millimètres.
Expanse of wings........	0·300 × 0·090	...	7·62 × 2·27
Size of body..............	0·250 × 0·050	...	6·34 × 1·27

♀.—Length of antennæ......	0·060 inch	...	1·54 millimètres.
Expanse of wings........	0·300 × 0·090	...	7·62 × 2·27
Size of body..............	0·260 × 0·050	...	6·62 × 1·27

Head covered with a greyish or yellowish-grey bloom, traversed on the front by black median line; rostrum, palpi and antennæ brown or black, basal joints of latter testaceous or brownish-ochreous. Thorax covered with a yellowish-grey bloom, with three brown or blackish stripes; intermediate one somewhat shining anteriorly, interrupted immediately before suture, but extending beyond it posteriorly; lateral ones short, not so distinct, but also extending beyond suture; humeral pits and suture black; humeri yellowish; pleuræ more or less ochreous, hoary, with two brown or blackish stripes, one from base of fore coxæ to root of halteres, the other above the intermediate and hind coxæ; scutellum ochreous, tinged with brown; metanotum sooty brown, hoary. Halteres infuscated, the stem more or less yellowish. Abdomen deep fuscous brown or black, shining, with yellowish hairs (more dense in ♂); lateral and posterior borders of segments with a narrow margin of ochreous or brownish-ochreous; genitalia brownish-ochreous. Legs testaceous; in ♂ densely clothed with

long, semi-erect blackish hairs; in ♀ with inconspicuous decumbent hairs; femora with a broad ring of brown or blackish immediately before tip; tibiæ brown or blackish at tip; tarsi deep brown or black. Wings slightly tinged with brownish; veins brown or blackish; tip of first longitudinal vein, the marginal cross-vein, præfurca, bases of sub-marginal cells, and fifth longitudinal vein often distinctly infuscated; stigma pale brownish. Auxiliary vein reaching costa before, opposite, or beyond marginal cross-vein; marginal cross-vein a little beyond inner end of first sub-marginal cell; discal cell often with a short stump of a vein from lower basal angle of second posterior cell; great cross-vein situated a little before inner end of discal cell.

Hab.—Swan River, W. Australia (Walker); Adelaide S. Australia (J. G. O. Tepper), *Coll. S. Aust. Museum*; Sydney, &c., N.S.W. (Masters and Skuse). Extremely abundant during August, September, and October.

Obs.—Schiner's *T. Sydneyensis* is certainly the female of Walker's species. Some specimens before me are larger than the above measurements, others are less than two-thirds the size. I can see very little other variation apart from sexual differences. More than one hundred specimens before me for comparison.

342. Trimicra microcephala, Thomson.

Limnobia microcephala, Thomson, "Eugenia" Exp. Dipt. p. 446, 1868.

♂.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·250 × 0·060	...	6·34 × 1·54
Size of body..............	0·180 × 0·025	...	4·56 × 0·62
♀.—Length of antennæ......	0·050 inch	...	1·27 millimètres.
Expanse of wings........	0·250 × 0·060	...	6·34 × 1·54
Size of body..............	0·220 × 0·025	...	5·58 × 0·62

Remarkably like the preceding in colouring and markings, but smaller. Legs of both sexes inconspicuously clothed with short

hairs; obscure testaceous; femora gradually darkening into deep brown or blackish towards the tip; extreme tip of tibiæ and the tarsi deep brown or blackish. Wings sub-hyaline, very slightly tinged; veins brown or blackish; cross-veins sometimes scarcely perceptibly infuscated; stigma pale brownish. The discal cell in certain specimens shows a tendency to open posteriorly; the anterior branch of fourth longitudinal vein in some instances originating with a short arcuation, and the discal cell closed with a pale cross-vein.

Hab.—Sydney; abundant during August, September and October (Masters and Skuse).

Obs.—Thomson's species, which is certainly not a *Limnobia* on account of its 16-jointed antennæ, nor a *Limnophila* because of its spurless tibiæ, seems undoubtedly to be identical with the smaller of our two common Sydney *Trimicræ*.

Genus 16. Gnophomyia, O.-Sacken.

Gnophomyia, O. Sack., Proc. Acad. N. Sc. Philad. p. 223, 1859; Mon. Dipt. N. Amer. IV. p. 172, t. 2. f. 5 (wing), t. 4. figs. 19 and 19a (forceps and ovipositor), 1869; Studies II. p. 198, 1887.

"Two sub-marginal cells; four posterior cells; a discal cell; the second longitudinal vein originates somewhat before the middle of the anterior margin, a considerable distance anterior to the tip of the auxiliary vein; præfurca very slightly arcuated at the basis, nearly straight; sub-costal cross-vein at a small or moderate distance (hardly exceeding the length of the great cross-vein) from the tip of the auxiliary vein; seventh longitudinal vein nearly straight. Wings glabrous. Antennæ 16-jointed. Tibiæ without spurs at the tip; tarsi with distinct empodia. The forceps of the male consists of two comparatively short basal pieces, and a pair of claw-shaped horny appendages; a second pair of horny appendages, below the first, is shorter and stouter." (Osten-Sacken).

343. Gnophomyia fascipennis, Thomson. (Pl. xxi., fig. 14). ♀ wing).

Limnobia fascipennis (♀), Thoms., "Eugenia" Exp. Dipt. p. 447, 1868; *Gnophomyia cordialis* (♂), O.-Sacken, Studies on Tipulidæ, II. p. 199, 1887.

♂.—Length of antennæ.....	0·065 inch	...	1·66 millimètres.
Expanse of wings........	0·230 × 0·060	...	5·84 × 1·54
Size of body..............	0·240 × 0·040	...	6·09 × 1·01
♀.—Length of antennæ......	0·065 inch	...	1·66 millimètres.
Expanse of wings........	0·230 × 0·060	...	5·84 × 1·54
Size of body..............	0·280 × 0·040	...	7·10 × 1·01

♂ and ♀.—Head black above, yellowish beneath; rostrum somewhat prolonged, in ♂ yellow or reddish-yellow, in ♀ reddish-brown or even black; palpi brown or black; antennæ brown or black in ♂, first joint of scapus at apex and basal half of second usually tinged with reddish-yellow or brownish, in ♀ both joints, except tip of second, yellow or reddish-yellow, the first joint often brownish above. Thorax reddish-yellow or yellowish-ferruginous, nitidous; a deep black spot on the mesonotum, usually larger and more pyriform in ♀, generally squarish in ♂; two lateral deep black stripes from below humeri to scutellum (rarely confluent anteriorly with the first spot), emitting a short branch in front of root of wings; metanotum with a large black truncate-cordiform spot (in one ♂ specimen the spot is absent, whilst in a ♀ the metathorax is entirely deep brown, or black). Halteres yellowish, with infuscated club. Abdomen in ♂ (including genitalia) reddish-yellow or yellowish-ferruginous, in ♀ superior segments deep and shining bluish or violaceous-black; the venter and ovipositor as in ♂. Legs pale brownish- or reddish-yellow, tips of femora and tibiæ usually brownish; tarsi more or less deeply infuscated. Wings in ♂ with a brownish tint, usually with two, often with three and sometimes without sub-hyaline spots, the first very

small before origin of second longitudinal vein, second larger, ill-defined, preceding the cross-veins, third a narrow shortened cross-band from tip of second longitudinal vein; in ♀ fuscous, with a distinct spot and two fasciæ situated as in ♂, the latter stretching almost across the wing, anal angle more or less sub-hyaline; stigma not noticeable; veins dark. Auxiliary vein reaching costa about midway between origin of second longitudinal and marginal cross-vein; sub-costal cross-vein situated before its tip a distance ⅓ longer than great cross-vein; præfurca straight, very slightly arcuated at base; marginal cross-vein at or a little beyond inner end of sub-marginal cell, sometimes not far from tip of first longitudinal; petiole of first sub-marginal cell about length of distance between tip of præfurca and small cross-vein; cross-vein closing inner end of discal cell usually almost obliterated; great cross-vein situated more or less beyond inner end of discal cell.

Hab.—Australia (Lotz., 1834, Vienna Mus.); Sydney (Eugenia Exp.); several localities in N.S.W. (Masters and Skuse). September to January. Twenty-five male and twelve female specimens are before me.

Obs—I had already referred Thomson's species to *Gnophomyia* when I discovered that Baron O.-Sacken had described the ♂ as another species under this generic title. The Baron also describes in the same paper (Studies II. p. 199), a species of *Gnophomyia* from Amazon River which he calls *fascipennis*, but this name being pre-occupied I would suggest that *Osten-Sackeni* be substituted in honour of the describer.

Genus 17. Gonomyia, Megerle.

Gonomyia, Meg., in litt., Meigen, Syst. Beschr. I. p. 146, 1818; *Taphrosia*, Rondani, Prodr. I. 1856; *Gonomyia*, O.-Sacken, Proc. Acad. Nat. Sc. Philad. III. p. 229, 1859; *Goniomyia* (amended name), O.-Sack., Mon. Dipt. N. Amer. IV. p. 176, pl. II. figs. 2

and 4 (wings), pl. IV. fig. 17 (genitalia), 1869; *Gonomyia*, O.-Sack., Studies, II. p. 200, 1887.

"One or two sub-marginal cells; the *first*, when present, *very short, sub-triangular*, owing to the shortness and the oblique direction of the anterior branch of the second longitudinal vein; no marginal cross-vein; four posterior cells; discal cell open or closed; when open it is coalescent with the *third* posterior cell;* wings glabrous. Antennæ 16-jointed, rather short. Feet long, slender; tibiæ without spurs at the tip; tarsi with distinct empodia. Forceps of the male with several branches and linear appendages. Ovipositor of the female slender, arcuated," (Osten-Sacken).

I cannot do otherwise than place the following species in this genus, though it seems to deviate in certain particulars from the normal type of *Gonomyia*; chiefly in the great length of the auxiliary vein, the structure of the discal cell and situation of the great cross-vein (which reminds one of *Gnophomyia*), and lastly in the uniform dull dark colouring of the body and legs, instead of the usually yellow colour. I regret that I have not seen a male specimen, in order to compare the structure of the forceps. This species cannot be well included in any of the five sections of the genus which have been recently defined by Baron O.-Sacken (Studies, II. pp. 201-202).

344. GONOMYIA LEUCOPHÆA, sp.n.

♀.—Length of antennæ......	0·047 inch	...	1·18 millimètres.
Expanse of wings.......	0·320 × 0·070	...	8·12 × 1·77
Size of body	0·260 × 0·030	...	6·62 × 0·76

* With merely individual exceptions, according to Baron O.-Sacken. But in the species now described, it is unmistakably the posterior branch of the fourth vein which is forked, so that in specimens with the discal cell open, the latter would be coalescent with the second posterior cell.

Cinereous, opaque. Rostrum, palpi and antennæ black; joints of flagellum elliptical, with very short hairs. Thorax with two longitudinal rows of very short yellowish hairs. Halteres with an ochreous stem and dusky brown club. Abdomen very sparingly pubescent; ovipositor shining brown, the lower valves ochraceous. Coxæ pale greyish-ochreous, the fore pair more cinereous. Remainder of joints sooty brown, their pubescence with a greyish reflection; base of femora slightly testaceous-brown. Ungues smooth; empodia distinct. Wings slightly greyish, greyish-ochreous at their origin; stigma very pale brownish-grey; veins sooty-brown. Auxiliary vein very long, reaching costa some distance beyond inner end of second sub-marginal cell and opposite the tip of fifth longitudinal vein; sub-costal cross-vein situated a short distance before its tip, equal to the length of great cross-vein; præfurca strongly arcuated at its origin; petiole of first sub-marginal cell forming an obtuse angle with præfurca at the small cross-vein, about equal in length to posterior branch of its fork; the distance between the tip of the first longitudinal and that of the anterior branch of the second longitudinal equal to the distance between both tips of the latter fork; inner end of second sub-marginal cell pointed (there is a distinct incrassation at this point) opposite inner end of first posterior cell; third longitudinal vein almost straight, slightly thicker than the neighbouring veins; discal cell elongated, its arcuated inner end situated considerably before the inner end of first posterior cell, the cross-vein closing its outer end situated opposite a point mid-way between the tip of the posterior branch of fourth longitudinal and tip of fifth longitudinal; the *posterior branch* of fourth longitudinal vein *forked*, the branch originating at a gentle arcuation opposite tip of fifth longitudinal vein; great cross-vein some distance beyond inner end of discal cell.

Hab.—Sydney; September (Skuse).

Obs.—Described from a single specimen.

Genus 18. Rhabdomastix, gen.nov.

Two submarginal cells, the first half the length of the second; four posterior cells; no marginal cross-vein; præfurca long, originating at an acute angle before the middle of the wing; discal cell small; wings glabrous. Antennæ 16-jointed, *very long, filiform, nearly twice the length of the entire body.* Legs long, slender, tibiæ without spurs at the tip; ungues small, smooth; empodia indistinct. Male forceps with an outer, straight, slender, horny appendage, microscopically serrated on the outer side, and an inner short, soft, elliptical one; also two long, slender, somewhat hooked, internal appendages (Pl. xxiv., fig. 57).

Rostrum and palpi short; antennæ very long; joints of the scapus equal in size, very small, globose; flagellar joints long, slender, cylindrical, evenly but not densely pilose, somewhat decreasing in length; last joint apparently terminated by a minute nipple-shaped projection. Front broad, convex; eyes glabrous, small, round, considerably separated on the under side. Collare short; suture of thorax very distinct. Halteres long, slender. Legs densely clothed with a minute pubescence. Wings very cuneiformly narrowed towards the base, with only a slight indication of an anal angle; glabrous, appearing as if covered with microscopic dots under a high power; veins glabrous, or almost so; stigma wanting. The tip of the auxiliary vein is some distance beyond the origin of the second longitudinal vein; the subcostal cross-vein wanting or only extremely indistinctly present at the tip of auxiliary vein; præfurca originating in a rather acute angle considerably before the middle of the wing; first longitudinal vein joining costa opposite distal end of discal cell; the anterior branch of the second longitudinal vein is short, shorter than the great cross-vein; petiole about one half the length of first sub-marginal cell; marginal cross-vein entirely wanting; inner ends of second sub-marginal, first posterior and discal cells in one line; small or anterior cross-vein as long or somewhat longer than the great cross-vein, almost as long as the discal cell; discal cell small,

hexagonal, longer than wide; the great cross-vein situated at or beyond the middle of its length; fifth, sixth and seventh longitudinal veins gently arcuated; the last short, scarcely reaching to one-third the length of the wing.

345. Rhabdomastix Osten-Sackeni, sp.n. (Pl. xxii., fig. 15).

♂.—Length of antennæ......	0·250 inch	...	6·34 millimètres.
Expanse of wings........	0·180 × 0·040	...	4·56 × 1·01
Size of body..............	0·145 × 0·020	...	3·66 × 0·50

Front dull brown; rostrum brownish or ochreous-brown; palpi and antennæ brown, the latter nearly twice the length of the body. Thorax dull brown, the scutellum sometimes more ochreous-brown. Halteres long and slender, brownish. Abdomen brown, clothed with short brownish hairs; forceps brownish-ochreous. Legs brown or ochreous-brown, with a light sericeous reflection in a certain light; the tarsi white. Wings pellucid, almost hyaline, glabrous, granulate on account of being covered with microscopic dots which represent rudimentary pubescence; margaritaceous reflections; veins greyish-brown. Auxiliary vein reaching costa at a point not quite half the distance from origin of second longitudinal vein to inner end of second sub-marginal cell; præfurca almost imperceptibly bent at its origin, almost straight, nearly equal in length to the remainder of the second longitudinal; the third longitudinal and following veins at apex of wing all gently arcuated posteriorly.

Hab.—Berowra, N.S.W. Three specimens in August (Masters and Skuse).

Obs.—I have named this species in honour of Baron Osten-Sacken, who has so greatly advanced Dipterology; especially by his unsurpassed knowledge of, and excellent publications, on Tipulidæ.

Genus 19: LECHRIA, gen.nov.

Two sub-marginal cells, the first very short, sub-triangular; four posterior cells; *no marginal cross-vein*, but *inner marginal cell closed by first longitudinal vein*, which ends at inner end of first sub-marginal cell; *small cross-vein* situated some distance *before inner end of second sub-marginal cell;* præfurca originating beyond the middle of the wing; discal cell closed, elongated, its inner half cuneate, and *its inner end situated before origin of præfurca;* wings glabrous. Antennæ 16-jointed, short. Feet long, slender; tibiæ with spurs; ungues small, smooth; empodia indistinct. Male forceps with two horny appendages; an outer linear one, and a longer somewhat hooked inner appendage; also five long, horny, needle-like processes of the internal apparatus (Pl. XXIV., fig. 58).

Rostrum nearly half the length of the head; palpi of moderate length, the first joint apparently slightly the longest, the last three rather thicker, equal. The antennæ little longer (if any) than the head; joints of scapus somewhat thick, sub-cylindrical, the first rather longer than the second; flagellar joints sub-cylindrical, with very short hairs. Eyes contiguous above, and almost so on the under side. Collare inconspicuous. Legs clothed with only a microscopic pubescence. Wings very cuneiformly narrowed towards the base, with only a slight anal angle; appearing covered with microscopic dots only under a high power; the veins at apical end of wings densely beset with minute hairs; stigma narrow, elongate, enveloping terminal portion of first longitudinal vein. The tip of auxiliary vein is opposite the end of præfurca and the small cross-vein; the sub-costal cross-vein at its tip; præfurca very short, originating at an angle; the first longitudinal gently arcuated into the second longitudinal, joining at the base of its fork; the first sub-marginal cell is very short; the anterior branch of the second longitudinal fork about half the length of the posterior, the latter converges towards the tip of the third longitudinal, and is equal in length to the petiole; second sub-marginal cell also with a short petiole; the small cross-vein situated a little

beyond middle of discal cell; the latter closed, elongated, its inner half cuneiformly narrowed, and its inner end a little before the origin of præfurca; the great cross-vein a short distance beyond inner end of discal cell; fourth longitudinal vein originating in fifth longitudinal at a little before one third the length of the wing, joined at its base to first longitudinal by a short cross-vein; fifth, sixth and seventh longitudinal veins straight.

The most striking peculiarities in the venation are, the course of the first longitudinal which terminates in the second, the absence of the marginal cross-vein, the first and second sub-marginal cells being both petiolate, the position of the small cross-vein, and lastly the shape and position of the discal cell.

This genus seems undoubtedly related to *Gonomyia.*

346. LECHRIA SINGULARIS, sp.n. (Pl. XXII., fig. 16).

♂.—Length of antennæ.. ...	0·040 inch	...	1·01 millimètres.
Expanse of wings........	0·210 × 0·057	...	5·33 × 1·44
Size of body.............	0·180 × 0·033	...	4.56 × 0·84

Head blackish or sooty brown. Rostrum, palpi and antennæ dark brown. Thorax brown, opaque, with a yellowish-grey bloom in a certain light. Halteres yellow, with slightly infuscated club. Abdomen brown, the venter more ochreous; forceps yellow. Legs dull ochre-yellow, the tips of the femora and the last three joints of tarsi infuscated. Wings hyaline, appearing covered with microscopic dots only under a high power; stigma long, narrow, brownish; veins brown. The venation as described in the particulars of generic characters.

Hab.—Wheeny Creek, Hawkesbury District. One specimen in January (Skuse).

Genus 20. TRENTEPOHLIA, Bigot.

Trentepohlia, Bigot, Ann. Soc. Ent. Fr. (3rd ser.) II., p. 473, 1854; *Mongoma*, Westwood, Trans. Ent. Soc. Lond. 1881, p. 364,

pl. XVII., fig. 1; O.-Sacken, Berl. Ent. Zeits. XXVI., p. 89, 1882; Studies, II., p. 203, 1887; *Trentepohlia*, Bergroth, Ent. Tidsk. 1888, p. 136, fig. 3 (wing).

Two sub-marginal cells; the first very short; second in immediate contact with the discal cell, consequently the small cross-vein is wanting; marginal cross-vein situated before the inner end of the first sub-marginal cell; discal cell open or closed; three or four posterior cells; anal cell closed; auxiliary vein reaching costa usually a very short distance before the tip of the first longitudinal vein. Antennæ 16-jointed. Tibiæ without spurs; tarsi without empodia.

I do not know sufficient about the species having only three posterior cells to criticise the above synonymy, but accept them as congeneric with those possessing four, on the authority of Dr. Bergroth. Baron Osten-Sacken has more than once suggested the relationship of *Limnobia Trentepohli*, Wied., and *Cylindrotoma albitarsis*, Dolesch., with Westwood's *Mongoma*, but the descriptions appear too incomplete to satisfactorily decide. In the above diagnosis I have combined the principal characters of the two sections.

In the species now described the tips of the auxiliary and first longitudinal veins join the costa at rather widely separate points (which also seems to be the case with *T. exornata*, Bergr.), thus differing from *T. fragillima*, Westw., and *T. tenera* and *pennipes*, O.-Sack., in which they terminate close together. (Pl. XXIV., fig. 59, forceps).

Two specimens in the Macleay collection, from Fiji Islands, are possibly distinct from *T. australasiæ*, but at any rate belong to a closely allied species. The auxiliary and first longitudinal veins are separated as in the Australian example; the præfurca is rather more than twice the length of the distance between the origin of the third longitudinal vein and the inner end of the discal cell;

the cross-vein closing the discal cell is situated, in one specimen at, in the other somewhat before, the base of the anterior fork. All have the base of the third posterior cell before that of the second posterior cell. The Fijian form has considerably longer legs (42 mm.); the white on the knees extends equally (2 mm.) on the femora and tibiæ; the apical third of the tibiæ is white; and the extreme base and rather more than the apical half of the metatarsus, with the remainder of the tarsal joints, white; also, the wings are longer than in *T. australasiæ*.

TABULATION OF HITHERTO DESCRIBED SPECIES.*

A. Posterior branch of the fourth longitudinal vein forked. Four posterior cells. Discal cell closed.

a. Tips of the auxiliary and first longitudinal veins in close proximity. Tarsi entirely white.

* Intermediate tibiæ with a short fringe of white hair on each side at the apex.

pennipes, O.-Sack. Studies II., p. 204. Borneo.

**Intermediate tibiæ simple. Tibiæ entirely white.

tenera, O.-Sack., Berl. Ent. Zeits., XXVI., p. 89. Phillippine Is.

Tibiæ fuscous, white at the base and apex.

fragillima, Westw., Trans. E. Soc. Lond. 1881, p. 364. Africa.

b. Tips of the auxiliary vein and first longitudinal veins considerably remote. Tarsi brown towards the base.

australasiæ, sp.n.

B. Posterior branch of the fourth longitudinal vein simple. Three posterior cells.

a. Discal cell open. Tarsi fuscous.

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* Based upon that of Dr. Bergroth (Ent. Tidsk., 1888, p. 136).

* Abdomen yellow, brownish-black at apex. Wings fuscous at apex.

Trentepohli, Wied., I. p. 551. Sumatra.

** Abdomen entirely fuscous-black. Wings with the apex and a middle transverse fascia of fuscous.

exornata, Bergr. Ent. Tidsk., 1881, p. 135. Africa.

b. Discal cell closed. Tarsi white.

albitarsis, Dolesch., II., Bijdr., p. 15. Java.

347. TRENTEPOHLIA AUSTRALASIÆ, sp.n. (Pl. XXII., fig. 17).

♂.—Length of antennæ......	— inches	...	— millimètres.
Expanse of wings........	0·250 × 0·055	...	6·34 × 1·39
Size of body..............	0·220 × 0·030	...	5·58 × 0·76

In the single specimen before me the head is wanting, and the thorax has been almost entirely destroyed by the pin. Thorax apparently ochreous. Halteres ochreous. Abdomen umber-brown, the first two or three segments ochreous beneath. Legs about 35 mm. in length. Coxæ ochreous. Femora and tibiæ brown; the femora white at apex (about 1 mm.), and the tibiæ very slightly white at base and considerably tipped (about 3 mm.) at apex. Tarsi yellowish, the basal half of the metatarsus deepening into brown. Wings sub-hyaline, tinted with brownish between the auxiliary and first longitudinal veins for the whole of their length; beautiful violaceous and cupreous reflections; veins dark brown. Auxiliary veins reaching costa opposite anterior extremity of marginal cross-vein, and separated a distance equal to the length of the latter from tip of first longitudinal vein; sub-costal cross-vein situated some distance before tip of auxiliary vein, and opposite posterior extremity of great cross-vein; first longitudinal vein extending beyond marginal cross-vein a distance equal to the length of latter; second longitudinal originating at $\frac{1}{3}$ the length of wing; præfurca a little longer than distance between origin of

third longitudinal vein and inner end of discal cell; great cross-vein situated a little before inner end of discal cell.

Hab.—Barron River, Northern Queensland (Froggatt). A single damaged specimen.

Genus 21. CONOSIA, v.d. Wulp.

Conosia, v.d. Wulp, Tijds. v. Entom. XXIII., p. 159, pl. x., figs. 5-7., 1880; O.-Sacken, Studies, II., p. 206, 1887.

Two sub-marginal cells; five posterior cells; a discal cell; auxiliary vein very long; sub-costal cross-vein situated before its tip a distance about equal to length of great cross-vein; marginal cross-vein joining the first sub-marginal cell near its inner end; *small cross-vein situated at or beyond the distal end of the discal cell.* Palpi short, *one-jointed.* Antennæ *12-jointed.* Tibiæ without spurs; empodia distinct; ungues long, smooth.

The palpi clearly consist of only one joint (Pl. XXIV., fig. 60, mouth parts) though Van der Wulp states that there are four, and figures them. Rostrum extremely short. Antennæ short, about one-third longer than the head; first joint thick, cylindrical, about one-third the length of entire antennæ; second globose, as wide as the first; third somewhat narrower, ovate; fourth and following joints small; the fourth globose, the rest gradually becoming more elongate until the terminal one is almost linear and about twice the length of the next preceding joint; verticillate-pilose (Pl. XXIV., fig. 61). Van der Wulp says "antennæ 14-articulatæ," but I think that the slender terminal joints have deceived him. The head is flattened, somewhat longer than broad; front broad, with an impressed line on each side; eyes round. Thorax gibbose, rather long, strongly projecting over the hinder portion of the head; a distinct small pit on each side behind the humeri; scutellum rather large, almost the width of the thorax; metathorax somewhat steep. Abdomen long, slender, cylindrical; male forceps

Limnophila-like, consisting of two sub-cylindrical basal pieces, with a horny claw-like appendage at apex, underneath which is a soft, somewhat pointed appendage (Pl. xxiv., fig. 62). Legs somewhat stout; the fore femora abruptly attenuated for their basal third. Wings shorter than the abdomen, tolerably broad, and a little dilated about the middle of the anterior margin. The veins above the third longitudinal have their tips slightly arcuated anteriorly, those below it have them arcuated posteriorly. Between the costa and auxiliary veins, beyond the origin of the præfurca, there is usually a variable quantity of venous reticulation, apparently originating in the costa, and sometimes actually forming distinct cross-veins. In all the specimens before me the auxiliary vein reaches the costa beyond the marginal cross-vein, the distance being somewhat variable; however, according to Van der Wulp's figure, the auxiliary vein in his specimen joins the costa some distance *before* the marginal cross-vein.

The first longitudinal vein ends in the costa near the posterior end of the stigma, and opposite a point a little beyond the distal end of the discal cell; according to Van der Wulp's figure it should join considerably before this, and opposite the origin of the third longitudinal vein. The marginal cross-vein is very oblique and has its posterior end generally opposite the tip of the auxiliary vein or thereabouts. The præfurca is a little shorter than the first sub-marginal cell, rather straight, but a little arcuated near its origin. The first sub-marginal cell commences a little before the second. The most remarkable character in the venation is that the small cross-vein is situated at the distal end of the discal cell, a position it is unknown to occupy in the wing of any other member of the family; on account of the position of the cross-vein the first posterior cell is unusually short; its inner end is more or less beyond the distal end of the discal cell. The discal cell is almost triangular, a little angular at the joining of the great cross-vein. The great cross-vein is situated a short distance beyond the inner

end of the discal cell, and is sometimes somewhat sinuous. Seventh longitudinal vein bisinuated towards its tip.

348. Conosia irrorata, Wiedemann.

Limnobia irrorata, Wied., Auss. Zweifl. I., p. 574, 1828; *Limnophila Crux*, Doleschall, Nat. Tijds. N. Ind. XIV., p. 388, pl. IV., f. 3, 1856 (?); *Conosia irrorata*, v. d. Wulp, Tijds. v. Entom. XXIII., p. 161, pl. X., figs. 5-7, 1880; Osten-Sacken, Studies II., p. 206, 1887.

♂.—Length of antennæ......	0·057 inch	...	1·44 millimètres.
Expanse of wings........	0·350 × 0·090	...	8·89 × 2·27
Size of body..............	0·500 × 0·042	...	12·70 × 1·06
♀.—Length of antennæ......	0·060 inch	...	1·54 millimètres.
Expanse of wings.... ..	0·420 × 0·100	..	10·66 × 2·54
Size of body.............	0·610 × 0·042	...	15·49 × 1·06

Greyish-ochreous, dull; the pubescence on the thorax and abdomen usually centred in minute brownish dots. Thorax with a more or less distinct brownish line, usually uninterrupted from collare to posterior border of metanotum. Club of halteres brownish. Abdomen more or less tinged with brownish, particularly the terminal segments; clothed with yellowish hairs; ♂ forceps concolorous with rest of body; ♀ ovipositor slightly curved upwards; upper valves shining testaceous, lower ones black. Coxæ and femora usually pale ochreous-yellow; last one or two tarsal joints brown. Wings irregularly spotted with clouds of brown in the costal (over the venous reticulation) and marginal cells; a rather prominent pointed streak of brown directed downwards to and enveloping the basal portion of third longitudinal vein; also origin of præfurca, basal half of great cross-vein and (often) tip of seventh longitudinal vein clouded with brown; the veins ochreous, all

numerously spotted with brown ; stigma brown, rather paler than the markings.

Hab.—Sydney and other localities in N.S.W., May to October. (Masters and Skuse); Brisbane, Queensland, (Mr. H. Tryon); usually found among grass.

Obs.—Two specimens in the Macleay collection labelled Nepaul and Fiji respectively, do not seem to exhibit any characters which would lead one to separate them from this species. The same remarkable species it appears also occurs in Borneo, Ceylon, China and the Arabian Desert.

Section IV. LIMNOPHILINA.

"Two sub-marginal cells; usually five, seldom four posterior cells; discal cell generally present; sub-costal cross-vein posterior to the origin of the second longitudinal vein, usually closely approximated to the tip of the auxiliary vein (considerably distant from it in *Trichocera* only). Eyes glabrous (pubescent in *Trichocera*). Normal number of antennal joints sixteen. Tibiæ with spurs at the tip; empodia distinct; ungues smooth." (Osten-Sacken).

The Section LIMNOPHILINA includes about a dozen recognized genera. The genera *Gynoplistia* and *Cerozodia*, peculiar to the Australian region, possess remarkable characters and are closely allied; the former seems numerous, but only two species of *Cerozodia* have been described. *Ctedonia*, Phil., from Chili, to which *Gynoplistia fusca*, Jaen., is referred, is, according to Baron Osten-Sacken, closely allied to *Cerozodia*. Except *Limnophila*, the other genera contain but few known species.

Genus 22. LIMNOPHILA, Macquart.

Limnophila, Macq., S. à B. Dipt. I. p. 95, 1834; *Limnomya*, Rondani, Prod. etc., IV. Corrigenda, 1861; *Limnophila*, O-Sacken, Mon. Dipt. N. Amer. IV. pp. 196-202, pl. 2, f. 6-10 (wings); pl. 4, f. 23-27 (genitalia), 1869; Studies, II. p. 209, 1887.

"Two sub-marginal cells; usually five, seldom four posterior cells; discal cell closed; sub-costal cross-vein posterior to the origin of the second longitudinal vein, usually closely approximated to the tip of the auxiliary vein. Wings glabrous. Eyes glabrous. Antennæ 16-jointed. *Tibiæ with spurs at the tip;* empodia distinct; ungues smooth." (Osten-Sacken.)

The genus is of universal distribution; its numerous species are remarkable for their discordant characters, some of which at first sight seem of too much importance to be merely specific, being in many cases common to a natural group of two, three, or more species, yet doubtfully of generic value; the entire assemblage of groups and isolated species being bound together by a tie which renders dismemberment difficult and unsatisfactory. Though the species are classified under two sections,—those with four, and those with five posterior cells to the wings,—this division is clearly far less natural than it is convenient; for some species in one section are found to be certainly more related to those in the other than they are to the species with which they are associated. It also seems impossible to attach more than specific importance to the length of the antennæ, which varies tremendously even in closely allied species. Baron Osten-Sacken considers that "the most reliable characters to guide us are those taken from the structure of the male forceps; but in order to be available, they must be supported by characters supplied by other parts of the organization." Working on this rule, he found it only possible to provisionally admit a few sub-generic divisions which await better definition, and to point out some groups of species which appear allied.

One species now described, *L. aureola,* approaches, but does not entirely correspond with, Baron Osten-Sacken's *L. recondita* and *imbecilla* group; and another, *L. rostrifera* clearly belongs to his *L. luteipennis* group; all the other species appear only to add to the perplexity of forms already known, though a few certainly couple together in groups. We must await further discoveries before this genus can be understood, or a satisfactory classification

of the species effected. Some species must be left in abeyance on account of the male sex being at present unknown.

I. FIVE POSTERIOR CELLS.

349. LIMNOPHILA LEUCOPHÆATA, sp.n. (Pl. XXII., fig. 18).

♀.—Length of antennæ	0·120 inch	...	3·04 millimètres.
Expanse of wings........	0·400 × 0·090	...	10·16 × 2·27
Size of body..............	0·440 × 0·050	...	11·17 × 1·27

Head brown, with a yellowish-grey bloom; front with a slightly darker median line; rostrum and palpi dark brown or blackish; antennæ brown, the two basal joints more or less ochreous; flagellar joints sub-cylindrical, slender, the first five or six becoming larger beneath at the apex; with short bristly verticils. Thorax brown, opaque, pruinose with greyish, with three more or less distinct narrow stripes; intermediate one terminating midway between collare and suture, and lateral ones reaching the suture; an almost crescent-shaped marking behind the humeral pits, stretching from below extremity of lateral stripes almost to suture; pleuræ with a pale greenish-ochreous, ochreous, or even sordid testaceous stripe from collare to scutellum (including origin of the wings), followed by a deep brown or black stripe which terminates at metanotum; the remainder brown or brownish; scutellum more or less tinged with yellowish or testaceous. Halteres infuscated, the base of stem ochreous. Abdomen deep brown, levigate; ovipositor long, slightly curved, the valves tinged with testaceous. Coxæ whitish to reddish-ochreous. Femora sordid or greyish-yellow, deepening into black before the tip, the tip white; tibiæ black or deep brown, with a moderately broad ring of white at base, and slightly tipped with white; tarsi white, except that in the fore legs the metatarsal joint is brown (just beyond the base) for half its length. Wings tinged with pale brownish for three-fourths of their length, the anterior margin brown to stigma, and the veins at apex with

several small brown clouds; the clear spaces in the wings almost whitish; a squarish space a little before origin of præfurca, followed by another of uncertain shape about middle of præfurca; the fourth and fifth longitudinal veins are more or less distinctly clouded at intervals with brown or brownish; a rather prominent brown spot at tip of anterior branch of second longitudinal vein; veins and stigma brown. Auxiliary vein reaching costa opposite the middle of petiole of first sub-marginal cell; the sub-costal cross-vein opposite inner end of second sub-marginal cell; sub-costal cell a little expanded just before the tip of first longitudinal vein; præfurca moderately long, straight except at the base; petiole of first sub-marginal cell usually about one-third the length of the præfurca; marginal cross-vein a little nearer inner end of first sub-marginal cell than to tip of first longitudinal vein; branches of second longitudinal, particularly the posterior one, arcuated; second sub-marginal cell longer than the first posterior cell by a distance equal to length of great cross-vein; second posterior cell about half the length of the first posterior cell; great cross-vein at inner end of discal cell; tips of fork of posterior branch of fourth longitudinal considerably, and tips of fifth and sixth longitudinal vein slightly arcuated; seventh longitudinal vein conspicuously sinuated.

Hab.—Neutral Bay and Middle Harbour, near Sydney (Skuse). On wet rocks near waterfalls in May and November.

350. LIMNOPHILA OBSCURIPENNIS, sp.n. (Pl. XXII., fig. 19).

♂.—Length of antennæ......	0·080 inch	...	2·02 millimètres.
Expanse of wings	0·340 × 0·075	...	8·62 × 1·89
Size of body..............	0·260 × 0·040	...	6·62 × 1·01
♀.—Length of antennæ......	0·080 inch	...	2·02 millimètres.
Expanse of wings.......	0·340 × 0·075	...	8·62 × 1·89
Size of body..............	0·320 × 0·040	...	8·12 × 1·01

Head brown, with a yellowish-grey bloom; rostrum, palpi and antennæ dark brown; first flagellar and apex of second basal joint usually ochreous-yellow; flagellar joints becoming very slender and cylindrical towards tip, the first flagellar joints elliptical; short bristly verticils. Thorax brown, with four pale, ochreous or greyish, narrow stripes; two intermediate ones stopping just before the suture; the lateral ones extending opposite the origin of the wings. Halteres brown. Abdomen brown; ♂ forceps brown, of ordinary structure; ♀ ovipositor long, a little curved, testaceous or ochreous. Legs light ochreous, densely clothed with tolerably long hairs; tibiæ and tarsi brownish at the tips. Wings almost completely tinged with brownish; the extreme apex clear whitish, usually from tip of anterior branch of second longitudinal to tip of anterior branch of fourth longitudinal vein; also usually a small whitish clear space at each end of stigma; stigma and veins brown. Auxiliary vein reaching costa about opposite inner end of second sub-marginal cell; sub-costal cross-vein a short distance before its tip; sub-costal cell a little expanded just before tip of first longitudinal vein; præfurca moderately long, almost straight (quite straight and originating at a very acute angle in some specimens); petiole of first sub-marginal cell as long or longer than great cross-vein; marginal cross-vein pale, situated mid-way between inner end of first sub-marginal cell and tip of first longitudinal vein; branches of second longitudinal, especially the posterior, arcuated; second sub-marginal cell slightly shorter than first posterior cell; second posterior cell short, less than half the length of first posterior; discal cell rather elongate, its inner end situated before that of the first posterior cell a distance nearly equal to length of great cross-vein; inner end of fourth posterior cell before that of third posterior a distance about equal to length of great cross-vein; great cross-vein beyond inner end of discal cell; seventh longitudinal vein sinuated.

Hab.—Sydney, Berrowa and Knapsack Gully, Blue Mountains, N.S.W. (Skuse). April and August.

351. Limnophila disposita, sp.n.

♀.—Length of antennæ......	0·045 inch	...	1·13 millimètres.
Expanse of wings........	0·290 × 0·080	..	7·35 × 2·02
Size of body..............	0·280 × 0·040	...	7·10 × 1·01

Head and antennæ ochreous-brown; rostrum and palpi dark brown. Thorax ochreous-brown, dull, infuscated anteriorly, with indistinct traces of longitudinal stripes; pleuræ and metanotum pruinose with yellowish. Halteres yellow. Abdomen ochreous-brown, somewhat darker than thorax, a little shining, clothed with short yellow hairs; ovipositor tolerably long, slightly curved, tinged with testaceous. Legs yellowish-tawny or ochreous; femora with a brown ring just before tip; tibiæ and first three tarsal joints infuscated at tip; last two tarsal joints entirely infuscated. Wings pellucid, with a yellowish or pale brownish tint; veins brown; stigma hardly perceptible. Auxiliary vein reaching costa opposite or short distance beyond inner end of second sub-marginal cell; sub-costal cross-vein situated before tip a distance about equal to length of great cross-vein; præfurca short, considerably arcuated at base; petiole of first sub-marginal cell about half the length of præfurca; marginal cross-vein about midway between inner end of first sub-marginal cell and tip of first longitudinal vein; branches of second longitudinal vein divergent but little arcuated; inner ends of second sub-marginal, first posterior and discal cells in one line; second posterior cell very small, not half the length of the third posterior; discal cell oblong; great cross-vein situated about the middle of its length; seventh longitudinal vein curved at its tip.

Hab.—Sydney (Masters and Skuse). Two specimens during September.

352. Limnophila aureola, sp.n. (Pl. xxii. fig. 20).

♂.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·180 × 0·057	...	4·56 × 1·44
Size of body..............	0·120 × 0·030	...	3·04 × 0·76

♀.—Length of antennæ......	0·055 inch	...	1·39 millimètres.
Expanse of wings........	0·240 × 0·065	...	6·09 × 1·66
Size of body......	0·130 × 0·030	...	3·30 × 0·76

Head, including rostrum, palpi, and antennæ light fulvous-yellow to brownish; flagellar joints slender, cylindrical, with spare bristly verticils. Thorax pale fulvous, somewhat shining, with two longitudinal rows of yellow hairs. Halteres yellow. Abdomen brown or brownish, more or less tinged with ochreous or fulvous; clothed with yellow hairs; ♂ forceps of ordinary type, concolorous with rest of body; ♀ ovipositor nearly straight, ochre-yellow. Legs yellow, densely clothed with tolerably long yellow hairs; tibial spurs small. Wings pellucid, with a faint yellowish tint; veins yellowish; stigma indistinct; the origin of the præfurca with a small, but distinct, brownish cloud; cross-veins and tips of all the veins just perceptibly clouded. Auxiliary vein shorter than usual, reaching costa beyond origin of second longitudinal vein a distance equal to about length of great cross-vein; sub-costal cross-vein a little beyond origin of the latter; præfurca moderately long, angularly bent at its origin, with a short stump of a vein, the rest straight; petiole of first sub-marginal cell somewhat more than one-third the length of præfurca; marginal cross-vein situated at inner end of first sub-marginal cell, and only a little before tip of first longitudinal vein; second sub-marginal cell somewhat longer than first posterior; inner end of latter in line with that of discal cell; second posterior cell short, less than half the length of third posterior; discal cell oblong;* great* cross-vein situated at the middle of its length; seventh longitudinal vein a little curved at its tip.

Hab.—Lawson, Blue Mountains (Masters). Two specimens in January.

Obs.—This species seems to approach the *L. recondita* and *L. imbecilla* group of Baron Osten-Sacken; but the auxiliary vein is shorter and the base of the second longitudinal differs in being strongly angulated.

353. LIMNOPHILA OCELLATA, sp.n. (Pl. XXII. fig. 21).

♂.—Length of antennæ......	0.040 inch	...	1·01 millimètres.
Expanse of wings........	0·210 × 0·047	...	5·33 × 1·18
Size of body..............	0·150 × 0·020	...	3·81 × 0·50
♀.—Length of antennæ.......	0·040 inch	...	1·01 millimètres.
Expanse of wings.	0·250 × 0·060	...	6·34 × 1·54
Size of body..............	0·210 × 0·030	...	5·33 × 0·76

Head brown, with a yellowish-grey or brownish bloom; rostrum ochreous-brown or brownish; palpi and antennæ black; flagellar joints cylindrical, the first two or three more elliptical. Thorax covered with a yellowish-grey or brown bloom, with three brown stripes; intermediate stripe extending from collare to suture, marked with two small approximate shining dots at one third of its length from anterior extremity; lateral stripes short; humeral pits prominent, in a line with intermediate dots; pleuræ, scutellum and metathorax with a greyish bloom. Halteres pale yellow. Abdomen dark brown or blackish; ♂ forceps dull ochreous or pale greyish-brown, the terminal appendages black, single, truncate, with a minute hook at the outer angle; ♀ ovipositor long, slender, very little curved, tinged with ochreous towards extremity. Coxæ greyish-ochreous. Remaining joints brown to black. Wings with a slightly greyish tint, marked with brownish (more inky when fresh), chiefly coalescent ocellate, spots; an incomplete ocellus has the origin of præfurca for its centre, and is coalescent with another more or less complete ocellus reaching to the posterior margin; others are more or less distinct, centred round the cross-veins, and generally coalescent; an ocellus at distal end of discal cell often distinct and very perfect; leaving two sub-hyaline transverse bands, the first opposite middle, the second opposite tip, of auxiliary vein. Auxiliary vein rather short, reaching costa opposite middle of præfurca; sub-costal cross-vein situate beyond origin of præfurca a distance equal to length of great cross-vein; præfurca

bent at an obtuse angle near its base, sometimes with a short stump of a vein, the rest straight, twice (or more) the length of petiole of first sub-marginal cell; marginal cross-vein usually indistinguishable, situated at or before inner end of first sub-marginal cell, and a little before tip of first longitudinal vein; inner ends of second sub-marginal and first posterior cells in one line; small cross-vein arcuated; second posterior cell usually less than half the length of the third posterior; discal cell elongate, as long or longer than third posterior cell; great cross-vein situated beyond its inner end; seventh longitudinal a little arcuated at its tip.

Hab.—Sydney and Berowra, N.S.W. (Skuse). April and June; also taken *in copulâ* during September.

Obs.—Ten specimens for comparison. The second posterior cell varies in size, even in the wings of a single specimen; it is entirely absent in one wing of a female specimen before me. The position of the dots on the intermediate thoracic stripe differs from that of *L. luteipennis*, *contempta* and *inornata*, O.-Sack., where they are situated at the anterior extremity, close to the collare.

354. Limnophila rostrifera, sp.n.

♀.—Length of antennæ......	0·085 inch	...	2·14 millimètres.
Expanse of wings........	0·410 × 0·090	...	10·41 × 2·27
Size of body..............	0·460 × 0·050	...	11·67 × 1·27

Head narrowed posteriorly, greyish-brown; collare prolonged, greyish-brown; rostrum the length of the head, greyish-brown; palpi dark brown; antennæ brown, the first joint of scapus greyish-brown; flagellar joints fusiform. Thorax with a greyish bloom, opaque, with three broad brown stripes; intermediate stripe apparently double, with two small shining black dots at its anterior extremity; lateral ones extending beyond the suture, more or less coalescent with base of intermediate stripe; humeral pits prominent; pleuræ and metathorax more or less hoary. Halteres ochreous, with infuscated club. Abdomen brown, superior segments bordered laterally and posteriorly with

ochreous; venter ochreous, or ochreous-brown; ovipositor long, slender, slightly curved, ochreous or testaceous. Coxæ ochreous or brownish-ochreous, somewhat hoary. Femora testaceous, darkening into brown at the tips; tibiæ and tarsi brown. Wings pellucid, with a very slight brownish tint; the costal (except at base) and sub-costal cells, origin of præfurca, inner ends sub-marginal and all the posterior cells clouded with brown; also margins round apex of wing clouded with brown; stigma elongate, brown; veins brown. Auxiliary vein reaching first longitudinal vein opposite or somewhat before inner end of second sub-marginal cell, connected near the tip by cross-vein to costa; præfurca of moderate length, arcuated at base; petiole of first sub-marginal cell equal in length to posterior branch of second longitudinal vein; the latter arcuated at its base, the remainder a little bent; marginal cross-vein situated beyond the middle of petiole of first sub-marginal cell, and a distance equal to its length from tip of first longitudinal vein; inner end of second sub-marginal cell rounded, situated a little before that of first posterior cell; small cross-vein a little arcuated, in line with inner end of discal cell; the latter at least as long as third posterior cell; second posterior cell less than half the length of third posterior; great cross-vein situated a short distance beyond inner end of discal cell; seventh longitudinal vein arcuated at its tip.

Hab.—Sydney? (Masters). Three specimens.

Obs.—This species approaches O.-Sacken's *L. luteipennis* group by the structure of the head, prolongation of collare, double dots on anterior extremity of intermediate thoracic stripe, &c., but the second sub-marginal cell is shorter, the posterior branch of the second longitudinal vein is only a little arcuated, and the rostrum is as long as the head.

355. Limnophila imitatrix, sp.n. (Pl. xxii. fig. 22).

♂.—Length of antennæ......	0·060 inch	...	1·54 millimètres.
Expanse of wings	0·380 × 0·080	...	9·64 × 2·02
Size of body.............	0·350 × 0·040	...	8·87 × 1·01

♀.—Length of antennæ......	0·060 inch	...	1·54 millimètres.
Expanse of wings........	0·410 × 0·090	...	10·41 × 2·27
Size of body..............	0·400 × 0·040	...	10·16 × 1·01

Head with a grey or yellowish-grey bloom; rostrum, palpi and antennæ black or dark brown; flagellar joints elliptical with very short verticils. Thorax covered with a grey or yellowish-grey bloom, traversed by three brown stripes; intermediate stripe terminating immediately before the suture; lateral ones shorter, narrow, reaching beyond suture; humeral pits black, shining; pleuræ, scutellum and metathorax blackish-brown with a greyish bloom. Halteres fulvous-yellow. Abdomen uniformly blackish-brown, clothed with short light hairs; ♂ forceps of ordinary type, concolorous with abdomen; ♀ ovipositor long, almost straight, reddish-brown. Coxæ and base of femora fulvous; remainder of joints usually uniformly dusky or blackish-brown, sometimes darker at the tips. Wings pellucid with a very pale brown tint, yellowish at the base; costal cell and inner ends of sub-marginal, discal and posterior cells, origin of præfurca, great-cross vein and tips of all the veins more or less distinctly clouded with brownish; veins dark brown; stigma pale. Auxiliary vein reaching first longitudinal vein opposite inner end of first sub-marginal cell, connected a short distance from its tip by a cross-vein to costa; præfurca moderately long, arcuated at base or angulated (sometimes with a short stump of a vein), otherwise straight; petiole of first sub-marginal cell very short, only about length of marginal cross-vein; inner end of first sub-marginal cell somewhat rounded; marginal cross-vein very pale and difficult to distinguish, cutting the middle of stigma, and situated scarcely nearer to tip of first longitudinal vein than to inner end of first sub-marginal cell; inner end of second sub-marginal cell rectangular; first posterior cell as long or very slightly longer than second sub-marginal; small cross-vein curved; discal cell usually a little wider at its distal end, its inner end somewhat before that of first posterior cell; second posterior cell half the length of third; great cross-vein at

middle of discal cell; seventh longitudinal vein a little arcuated at the tip.

Hab.—Mount Kosciusko, N.S.W., 5-6000 ft. (Helms). March; *nine specimens in Coll. Australian Museum.*

Obs.—Very like *L. rostrifera* in size, colour of legs, and vein-cloudings but in all other respects a very different insect.

356. Limnophila antiqua, sp.n. (Pl. xxii., fig. 23).

♂.—Length of antennæ......	0·140 inch	...	3·55 millimètres.
Expanse of wings........	0·380 × 0·090	...	9·64 × 2·27
Size of body..............	0·320 × 0·040	...	8·12 × 1·01
♀.—Length of antennæ......	0·130 inch	...	3·30 millimètres.
Expanse of wings........	0·400 × 0·090	...	10·16 × 2·27
Size of body..............	0·380 × 0·040	..	9·64 × 1·01

Head more or less slaty-grey, tinged with ochreous; rostrum and palpi black; antennæ ochreous, the two basal joints sometimes brown or brownish (in one specimen blackish); flagellar joints long, cylindrical, ringed with brown at the base, densely and uniformly covered with short hairs interspersed with some longish bristles. Thorax very gibbose, projecting over the head, ochreous or greyish-ochreous (sometimes light brownish), opaque, with a prominent brown band round mesonotum, across pleuræ, to base of abdomen; two longitudinal rows of brown hairs; prosternum with a narrow longitudinal brown stripe; metanotum long. Halteres very long and slender, ochreous, the club more or less infuscated. Abdomen ochreous-brown or brownish; ♂ forceps brown or brownish, terminating with two beak-like movable appendages, densely covered with minute hairs, the outer one slightly hooked at the tip (pl. xxiv., fig. 63); ♀ ovipositor slightly curved, tinged with reddish-brown. Legs yellow, or brownish-yellow. Wings with a pale brownish tint, entirely covered with numerous brownish dots or small spots in all the cells; a

somewhat, though not conspicuously, larger spot at the tip of most of the veins and at origin of præfurca; and a still larger, prominent, more or less wedge-shaped marking, based on the costa at tip of auxiliary vein and terminating at small cross-vein; veins brown or brownish; stigma elongate, pale. Auxiliary vein joining costa or first longitudinal* vein a short distance beyond inner end of first sub-marginal cell; sub-costal cross-vein near its tip; præfurca moderately long, arcuated, or even angulated, at its origin; petiole of first sub-marginal cell short, about equal in length to great cross-vein; branches of second longitudinal vein and the third longitudinal arcuated downwards; second submarginal and first posterior cells equal in length; small cross-vein somewhat arcuated; marginal cross-vein usually pale, situated a short distance from tip of first longitudinal vein; second posterior cell about two-thirds the length of third posterior; discal cell somewhat wider at its distal end, not long, its inner end situated a little before that of first posterior cell; great cross-vein at the middle or nearer the distal end; all the veins terminating on posterior margin slightly arcuated at the tip; seventh longitudinal vein distinctly arcuated at its tip.

Hab.—Sydney and Blue Mountains, N.S.W. (Masters and Skuse). Six specimens. October.

Obs.—This and the following species, *L. interventa*, are closely allied, and I have also a damaged specimen of another undescribed species with marbled wings which is nearly related. *L. antiqua* and *interventa* agree in the structure and markings of the antennæ, head and thorax, etc., differing principally in the venation and markings of the wings. In *L. interventa* the veins only are spotted.

357. Limnophila interventa, sp.n. (Pl. xxii., fig. 24).

♀.—Length of antennæ.......	0·140 inch	...	3·55 millimètres.
Expanse of wings.	0·450 × 0·095	...	11·42 × 2·39
Size of body...............	0·400 × 0·040	...	10·16 × 1·01

* It is impossible to decide which is the tip of the auxiliary vein and which the sub-costal cross-vein.

Structure and colouring of antennæ, thorax, and halteres entirely resembling *L. antiqua*; except that the thoracic brown band is obliterate on the mesonotum; and the abdomen ochreous, mottled with brownish. Wings pellucid, with a very pale brownish or yellowish tint; veins brownish, the costal, auxiliary and first longitudinal veins ochreous; the bases and tips of all veins, each end of the cross-veins, and inner ends of cells, with a very small brownish spot, imparting an indistinctly spotted appearance to the wings; præfurca clouded for a short distance at its origin; veins and stigma pale. Auxiliary vein reaching costa some distance beyond the inner end of first sub-marginal cell; sub-costal cross-vein situated near its tip; præfurca rather shorter than in *L. antiqua* (consequently the cells at apex of wing longer) obtusely angulated at its origin; petiole of first sub-marginal cell half the length of præfurca; branches of second longitudinal vein and the third longitudinal vein arcuated and running parallel as in *L. antiqua*; marginal cross-vein distinct, situated considerably before the tip of first longitudinal vein; inner end of second sub-marginal cell a short distance before that of first posterior cell and opposite that of discal cell; small cross-vein short, straight; second posterior cell about two-thirds the length of third posterior cell; discal cell elongate, twice the length of that of *L. antiqua*, the cross-vein closing its distal end being almost opposite the tip of fifth longitudinal vein; inner end of third posterior cell nearly opposite the middle of discal cell; great cross-vein opposite middle of discal cell; all the veins terminating in posterior margin a little arcuated at the tip.

Hab.—Northern Queensland (?). A single specimen.

358. Limnophila inordinata, sp.n. (Pl. xxii., fig. 25).

♂.—Length of antennæ......	0·045 inch	...	1·13 millimètres.
Expanse of wings........	$0·350 \times 0·080$	...	$8·87 \times 2·02$
Size of body...............	$0·250 \times 0·035$	...	$6·34 \times 0·88$

Head greyish-brown; rostrum, palpi, and antennæ brown; flagellar joints elliptical, with very short verticils. Thorax

covered with a yellowish-grey bloom, with three brown stripes; intermediate stripe broad, terminating at suture; lateral ones narrow, stopping at a brown spot opposite origin of wings; pleuræ brown. Halteres pale. Abdomen blackish-brown; forceps (apparently) of ordinary type, concolorous with rest of body. Legs brown, the tips of femora and tibiæ infuscated. Wings with a somewhat greyish tint; veins brownish, the bases and tips of veins, the cross-veins, and inner ends of cells very indistinctly infuscated; stigma very faintly infuscated. Auxiliary vein joining first longitudinal vein a little beyond inner end of second sub-marginal cell, joined to costa by a cross-vein exactly opposite the inner of that cell; præfurca moderately long, angulated near its origin, with a short stump of a vein; petiole of first sub-marginal cell less than one-fourth the length of præfurca; inner end of first sub-marginal cell rather acute, somewhat obliterate; marginal cross-vein very indistinct, cutting middle of stigma, and situated midway between inner end of first sub-marginal cell and tip of first longitudinal vein; second sub-marginal and first posterior cells of about equal length; small cross-vein curved; second posterior cell half the length of third; the latter shorter than fourth posterior cell;* discal cell elongate, the great cross-vein opposite the middle of its length; fifth and seventh longitudinal veins a little arcuated at the tip.

Hab.—Waterloo Swamps, near Sydney (Skuse). One specimen in June.

Obs.—There are some rather weak pieces of *adventitious* vein in the wings; in one wing a long curved piece originates from the fourth longitudinal vein opposite middle of præfurca; in both, an irregular very oblique piece forms a cross-vein across the middle of second basal cell; also in one wing there is a small stump of a vein near the tip of the seventh longitudinal vein.

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* The posterior branch of fourth longitudinal vein being forked.

II. FOUR POSTERIOR CELLS.

359. LIMNOPHILA METALLICA, Schiner.

Limnophila metallica, Schiner, "Novara" Exp. Dipt. p. 41, 1868.

♂.—Length of antennæ......	— inch	...	— millimètres.
Expanse of wings........	0·400 × 0·090	...	10·16 × 2·27
Size of body..............	0·370 × 0·070	...	9·39 × 1·77

Chalybeous blue. Head deep black, covered with black pubescence, the anterior portion of the front distinctly gibbose; rostrum, palpi and antennæ blackish or dark brown; rostrum short; palpi prominent; antennæ setaceous (portion lost), rather densely clothed with semi-decumbent hairs; first basal joint rather short and cylindrical, the second small, globose, not half the length of first; flagellar joints sessile, the first flagellar joint longer and thicker than the following ones, sub-spatulate. Collare black, inconspicuous. Thorax not such a brilliant metallic blue as the abdomen, but more blackish; pleuræ and pectus sooty-black or dark brown. Halteres blackish or dark brown. Abdomen clothed with minute blackish hairs; forceps short, black. Legs blackish, or deep brown. Wings entirely infuscated with a blackish or brown tint; veins dark; stigma imperceptible. Auxiliary vein terminating a little beyond inner end of second sub-marginal cell; sub-costal cross-vein at its tip; præfurca nearly straight, originating before the middle of the wing; petiole of first sub-marginal cell half the length of upper branch of second longitudinal vein; marginal cross-vein situated nearer inner end of first sub-marginal cell than to tip of first longitudinal; second sub-marginal cell longer than the first posterior; small cross-vein straight; discal cell a little longer than broad, the great cross-vein somewhat beyond its inner end; ultimate section of fifth longitudinal vein only equal to length of great cross vein, being abruptly turned to posterior margin.

Hab.—Sydney (Masters). One specimen.

Obs.—This species is remarkable for its metallic blue colour, dark wings, and broad, closely applied head. The antennæ it seems would scarcely reach the origin of the wings, the first seven joints measuring only 1·66 mm. There does not appear to be anything peculiar about the ♂ forceps, which are, however, difficult to examine in a dried specimen.

360. Limnophila luctuosa, sp.n. (Pl. xxii., fig. 26).

♀.—Length of antennæ......	0·035 inch	...	0·88 millimètre.
Expanse of wings........	0·250 × 0·060	...	6·34 × 1·54
Size of body..............	0·250 × 0·030	....	6·34 × 0·76

Head covered with a yellowish-grey bloom (shining black when rubbed); rostrum, palpi, and antennæ black; flagellar joints globose to elliptical, with very short, sparse verticils. Thorax covered with a yellowish-grey bloom, with three brownish stripes; the intermediate one disappearing before reaching the suture; lateral ones very short, reaching suture; pleuræ, scutellum, and metanotum with a hoary bloom (the ground colour deep brown). Halteres yellow. Abdomen brown, sparingly clothed with short yellowish hairs; ovipositor brownish-ochreous or fulvous. Coxæ and femora fulvous, the latter brown at the tip; tibiæ brownish, infuscated at the tip; tarsi infuscated. Wings with a scarcely perceptible brownish tint; veins brownish; stigma brownish-grey. Auxiliary vein reaching costa opposite or before inner end of second sub-marginal cell; sub-costal cross-vein a little before its tip; præfurca rather short, arcuated at its origin; petiole of first sub-marginal cell one-third to half the length of præfurca, and about half the length of anterior branch of second longitudinal vein; marginal cross-vein cutting stigma, and situated beyond inner end of first sub-marginal cell a distance about equal to its length, and more than twice that from tip of first longitudinal vein; inner ends of second sub-marginal and first posterior cells in one line; small cross-vein a little arcuated; discal cell elongated, the great cross-vein more or less beyond its inner end.

Hab.—Gosford, N.S.W., and Middle Harbour, Sydney (Skuse); Mount Kosciusko, N.S.W., 5000 ft. (Helms), *one specimen in Coll. Australian Museum.*

Obs.—I have taken only two specimens of this species.

361. Limnophila levidensis, sp.n. (Pl. xxii., fig. 27).

♂.—Length of antennæ......	0·030 inch	...	0·76 millimètre.
Expanse of wings........	0·220 × 0·045	...	5·58 × 1·13
Size of body	0·180 × 0·025	...	4·56 × 0·62
♀.—Length of antennæ......	0·035 inch	...	0·88 millimètre.
Expanse of wings........	0·250 × 0·060	...	6·34 × 1·54
Size of body..............	0·190 × 0·030	...	4·81 × 0·76

Head black, with a grey bloom; rostrum, palpi and antennæ black; basal joints of latter brown; flagellar joints sub-cylindrical, with very short verticils. Thorax greyish-ochreous or light brownish, mesonotum brownish in the ♀, levigate; transverse suture brown in the middle. Halteres pale, the club infuscated. Abdomen olive-brown, the venter paler; genitalia ochreous; ♂ forceps of ordinary type, terminal appendages black; ♀ ovipositor long, slender, slightly arcuated. Coxæ ochreous or pale brownish. Femora deep olive-brown; tibiæ and tarsi black. Wings with a greyish tint; veins dark; stigma greyish. Auxiliary vein terminating opposite or a little before inner end of second sub-marginal cell; sub-costal cross-vein considerably before its tip, that is, a distance at least equal to great cross-vein; præfurca tolerably long, nearly straight; first sub-marginal cell as long as præfurca, with a short petiole; marginal cross-vein indistinct, cutting stigma much nearer tip of first longitudinal vein than to inner end of first sub-marginal cell; inner ends of second sub-marginal and first posterior cells in one line; small cross-vein scarcely arcuated; discal cell elongated, the great cross-vein situated considerably beyond its inner end; fifth, sixth and seventh longitudinal veins more or less arcuated towards the tip.

Hab.—Mossman's Bay, near Sydney (Skuse). A pair *in copulâ* in August.

Obs.—Readily distinguished from *L. luctuosa* by the lighter thorax destitute of stripes, dark legs, greyish-tinted wings, dark veins, and length of præfurca and first sub-marginal cell.

362. LIMNOPHILA LAWSONENSIS, sp.n. (Pl. XXII., fig. 28).

♂.—Length of antennæ.....	0·640 inch ...	16·25 millimètres.
Expanse of wings.........	0·260 × 0·065 ...	6·62 × 1·66
Size of body...............	0·210 × 0·035 ...	5·33 × 0·88
♀.—Length of antennæ......	0·080 inch ..	2·02 millimètres.
Expanse of wings........	0·270 × 0·065 ...	6·85 × 1·66
Size of body...............	0·270 × 0·035 ...	6·85 × 0·88

Head brown, with a somewhat yellowish-grey bloom; rostrum, palpi and antennæ brown; ♂ antennæ more than three times the length of entire body, setaceous, densely clothed with very short almost erect pubescence; the incisions between the first few flagellar joints yellowish, the rest not distinguishable; ♀ antennæ short, exactly reaching origin of wings if bent back; the second basal joint reddish-fulvous, and the first seven or eight flagellar joints reddish-yellowish at the tip; first flagellar joint one-third longer and distinctly thicker than the second; remaining joints gradually decreasing in length, those towards the tip sub-elliptical. Thorax brown, levigate, marked with several short stripes of greyish or yellowish-grey bloom; pleuræ slightly hoary; scutellar pits distinct, blackish. Halteres ochreous-yellow, the stem very slightly infuscated. Abdomen brown, clothed with yellowish hairs; genitalia reddish-testaceous; ♂ forceps with two pairs of short movable appendages; the outer one sub-clavate, serrate on the outside towards and at the tip; inner one arcuate (Pl. XXIV., fig. 64); ♀ ovipositor long, almost straight. Coxæ, femora and tibiæ testaceous to brownish-ochreous; the femora with a broad ring of

black near the tip, preceded and followed (at the tip) by a narrow ring of golden-yellow; tibiæ infuscated at the base and tip (the extreme base golden-yellow); tarsi brown or brownish, the metatarsal joints more or less testaceous. Wings sub-hyaline, spotted with brown, more completely so in ♀ than ♂; basal cells in ♀ almost entirely clouded; in ♂ only at the ends and two roundish spots, one at præfurca, the other larger, beneath, in second basal cell; an oblong spot in anal cell filling space before the middle; similar clouds on margin in anal angle, and mid-way between the tips of sixth and seventh longitudinal veins; the remaining clouds more or less round, situated close to the tips of all the veins, and on the cross-veins, those on the latter confluent (Pl. xxii., fig. 28, ♀ wing); veins brown; stigma not noticeable. Auxiliary vein reaching costa some distance before inner end of second sub-marginal cell; sub-costal cross-vein a little before its tip; præfurca of moderate length, arcuated close to its base; petiole of first sub-marginal cell about (more or less) twice the length of anterior branch of second longitudinal vein; the latter branch obliquely situated, very slightly sinuose, joining costa a little beyond the tip of first longitudinal vein; posterior branch of second longitudinal vein slightly arcuated anteriorly, rather longer than petiole of first sub-marginal cell; marginal cross-vein wanting; inner end of second sub-marginal cell situated considerably before that of first posterior cell; small cross-vein short; third posterior cell considerably longer than the second posterior; discal cell elongate, the great cross-vein situated at its inner end; fifth, sixth and seventh veins arcuated at the tip, the seventh the most noticeably.

Hab.—Lawson, Blue Mountains, N.S.W. (Masters). Two specimens in January.

Obs. 1.—A ♀ specimen obtained by Mr. A. G. Hamilton at Mount Kembla, Illawarra District, appears to belong to this species; it is however considerably damaged. The anterior branch of second longitudinal vein differs in being almost vertical, joining the costa

immediately beyond the tip of the first longitudinal vein, and looking like a cross-vein.

Obs. 2.—This and the following species, *L. australasiæ*, form a natural group, and might be considered at least a distinct sub-genus. The antennæ are long in the male, short in the female; in *L. Lawsonensis* the male antennæ being more than three times the length of the entire body. The head is broad; collare inconspicuous. Male forceps (Pl. XXIV. fig. 64) with a serrate, clavate, outer appendage, and an inner arcuated one. Femora ringed before the apex. Wings numerously spotted with brown. Auxiliary vein stopping considerably before the inner end of the second sub-marginal cell; marginal cross-vein entirely wanting; first sub-marginal cell short, with a long petiole; the anterior branch of the second longitudinal vein joining the costa not far beyond the tip of the first longitudinal vein; second sub-marginal cell longer than first posterior; third posterior cell longer than second; great cross-vein usually at inner end of discal cell.

363. LIMNOPHILA AUSTRALASIÆ, sp.n. (Pl. XXIII. fig. 29).

♂.—Length of antennæ......	0·190 inch	...	4·81 millimètres.
Expanse of wings........	0·260 × 0·065	...	6·62 × 1·66
Size of body..............	0·220 × 0·035	...	5·58 × 0·88
♀.—Length of antennæ......	0·070 inch	...	1·77 millimètres.
Expanse of wings........	0.290 × 0·090	...	7·35 × 2·27
Size of body..............	0·250 × 0·035	...	6·34 × 0·88

Head brown, with a yellowish-grey bloom; rostrum, palpi and antennæ brown, the first few joints of latter usually more or less testaceous; ♂ antennæ not quite the length of entire body, setaceous, densely clothed with tolerably long, almost erect pubescence; flagellar joints gradually decreasing in length, the incisions between the first seven or eight ochreous; ♀ antennæ short, scarcely reaching origin of wings if bent back; flagellar joints sub-elliptical,

the first cylindrical, about the length of second and third taken together. Thorax covered with yellowish-grey bloom, with brown stripes and spots*; two more or less distinct, somewhat irregular, intermediate stripes terminating at transverse suture; two lateral ones from below humeri to above origin of wings; a roundish spot on each side at the back of mesothorax; a deep brown stripe on lateral border from collare to origin of wings; pleuræ covered with a greyish or yellowish-grey bloom, with a short brown stripe midway between origin of wings and fore coxæ; scutellum and metathorax more or less covered with greyish bloom, the scutellar pits distinct, brown. Halteres ochreous-yellow, the club usually slightly infuscated. Abdomen brown; the posterior margins of segments and venter more or less ochreous; genitalia reddish-testaceous, similar in structure to *L. Lawsonensis*. Legs ochreous or dull testaceous; the joints ringed as in *L. Lawsonensis*. Wings sub-hyaline, in both sexes spotted exactly as in the ♂ of *L. Lawsonensis*; venation very similar to that of last species, except that the anterior branch of second longitudinal vein in all cases joins the costa beyond the tip of first longitudinal vein a distance at least equal to its length.

Hab.—Woronora, and Knapsack Gully, Blue Mountains, N.S.W., 5 ♂, 7 ♀ specimens (Masters and Skuse); King George's Sound, Western Australia (Masters), *two ♀ specimens in Coll. Australian Museum.*

Obs.—Easily distinguished from *L. Lawsonensis* by the shorter male antennæ, which are less than the length of the body in this species.

364. Limnophila vicaria, Walker.

Limnobia vicaria, Walk., Ent. Mag. II. p. 469, 1835.

Like *Lim. geniculata* (Meigen, Syst. Beschr. II. pl. 2, fig. 15, wing).

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* The pattern in the thorax seems only a modification of that in *L. Lawsonensis*.

"♀.—Fusca, obscura; caput fulvo-fuscum, angustum; oculi obscurè fusci; antennæ fuscæ, capite paullò longiores; thorax subtus et posticè fulvus; abdomen obscurè fuscum, longum, gracile; femora ferè omnia tibiæ que basi et apice pallidè fusca; tarsi apice et ungues nigri; alæ subhyalinæ, iridescentes; costa fusca, basi pallidior, maculis plurimis subhyalinis; subcostam maculæ 4 majores sub fuscæ; squamulæ et nervi fusca; nervi omnes longitudinales punctis fuscis ornati; nervulus transversus discoidalis fusco limbatus; halteres pallidè fulvi, apice fusci." Corp. long. 7 lin.; alar. 10 lin.

Hab.—New Holland.

365. Limnophila basalis, Walker.

Limnobia basalis, Walk., Ins. Saund. Dipt. p. 434, 1856.

(Div. E. Meig, Syst. Beschr. II. p. 125, pl. 6, fig. 2).

"Nigra, nitens; alæ nigricantes, venis nigris."

"♀.—Black, shining. Oviduct short, nearly cylindrical. Wings blackish; veins and halteres black. Length of the body 5 lines; of the wings 10 lines."

Hab.—Van Diemen's Land.

Genus 23. Gynoplistia, Westwood.

Gynoplistia, Westw., Lond. and Edinb. Phil. Mag. VI. p. 280, 1835; *Gynoplistes* [nec *Anoplistes*] Westw., Zool. Journ., V., p. 447 (No. 20, 1835); *Gynoplistia*, Macquart, S. à B. II. Suppl. p. 649, 1835; Dipt. Exot. I. p. 43, 1838; *Variegata*, Bigot, Ann. Soc. Ent. Fr. 1854, p. 456; *Cloniophora*, Schiner, Wien. Ent. Monatschr. 1866; "Novara" Exp. Dipt. p. 40, 1868; *Cœnarthria*, Thomson, "Eugenia" Exp. Dipt. p. 445, pl. ix. f. 1, 1868; *Gynoplistia*, O.-Sack., Mon. Dipt. N. Amer. IV. App. II. p. 331, 1869; Westw., Trans. Ent. Soc. Lond. 1881, p. 369. pl. xviii. figs. 5-6-7; O.-Sack., Studies, II. p. 210, 1887.

Two sub-marginal cells; five (rarely only four*) posterior cells; discal cell closed; auxiliary vein reaching costa more or less opposite inner end of second sub-marginal cell; sub-costal cross-vein near its tip; first longitudinal vein reaching costa about opposite middle of anterior branch of second longitudinal vein; first sub-marginal cell with a short petiole; seventh longitudinal vein distinctly sinuated. Wings glabrous. Eyes glabrous. Antennæ 16- to 20-jointed, usually most of the flagellar joints unipectinate in both sexes. Tibiæ spurred; empodia distinct; ungues smooth. The forceps of the male *Limnophila*-like; usually with only one horny claw-shaped appendage.

Rostrum short, with large suctorial labella. Head wider than long; eyes round, slightly emarginate at base of antennæ; front broad; palpi tolerably long, joints about equal or the first shortest. The antennæ usually short, shorter in ♀ than in ♂, seldom reaching beyond the root of the wings if bent backwards, reaching beyond only in *G. vilis* (♂); the number of joints varies from 16 to 20 in both sexes, the number being somewhat variable in individuals of the same species; in ♂ the first 10 to 15, and in ♀ the first 8 to 12, flagellar joints unipectinate, the branches shorter in ♀ than in ♂ (in *G. jucunda*, O.-Sack., from Celebes, only the first 6 flagellar joints are branched in both sexes); the branches are on the inner side of the antennæ, except the two first which are directed outwards, only in *G. vilis* are the three first directed outwards. Baron Osten-Sacken (Studies II. p. 210), says "the three first branches in all the species are inserted sideways, and hence are pointing in a direction different from that of the others," but I find that the third branch, in all but *G. vilis*, is inserted scarcely more sideways than the following ones; in the last-named species, the fourth branch is situated similarly to the third in the remaining species. Macquart's figures of the antennæ of *G. vilis* (Dipt. Exot. 4th Suppl. pl. i. fig. 2) and of *G. bella* (*variegata*, Macq.) correctly show the difference between them. The terminal joints of the

* Only four posterior cells in *Gyn. jucunda*, O.-Sack., from Celebes (Ann. del Mus. Civ. di St. Nat. di Gen. XVI. 1881, p. 405).

flagellum are subject to slight modifications; the last two, three or four branches on the flagellum diminish in length, the last one or two sometimes a mere tooth or very rudimentary; the terminal simple joints vary from 2 to 7, generally more in the ♀ than in the ♂, the last of all is usually cylindrical and longer than the rest. Westwood's division of the species into two sections based upon the number of branched flagellar joints is useless, and was evidently the result of the examination of a very limited number of specimens. His first section contains two species, *G. vilis* and *cyanea*, the ♂ antennæ of which have the first 15 flagellar joints branched, in the second section the first 12 only. But some species of *G. vilis* have only the first 14, whilst some of *G. bella* have the first 15 branched. However the ♂ antennæ of *G. vilis* (possibly also of *G. cyanea*) certainly differ from those of all others in the direction of the first three branches; the ♂ forceps also exhibits a considerable difference.

The thorax is large; collare moderately devoloped. Legs tolerably strong, more particularly the hind pair; tibiæ spurred; empodia distinct; ungues smooth. Abdomen broader in ♀ than the ♂; the last two or three segments in ♂ usually somewhat broader than the preceding, the forceps usually narrowed; the abdomen in ♂ of *G. vilis* and *G. flavipennis* is comparatively longer and more cylindrical than in the other species; the second to fifth or sixth segments are narrowed in *G. melanopyga* and *G. bimaculata*; base of abdomen only slightly narrower in *G. bella* and *G. viridis*. The male forceps (Pl. XXIV., figs. 65-70) consists of a pair of short, fleshy, basal pieces armed usually with a single claw-shaped horny appendage; in *G. melanopyga* this appendage differs from the others in being more blunt and tridentate at the extremity; whilst the forceps of *G. vilis* departs considerably from the common type in being armed with three claw-shaped appendages, one of which is a fixture and another minutely bidentate at the end The visible appendages of the internal apparatus are variable. I have seen what I take to be the membranous opercule mentioned by Macquart (Dipt. Exot. I. p. 43) in only one species,

G. bella; it is also present in *G. annulata*, according to Baron Osten-Sacken. The ♀ ovipositor is broad at the base, the upper valves long, curved, and the lower ones shorter and straight.

The venation is not subject to very great variation. The auxiliary vein joins the costa more or less opposite the inner end of the second sub-marginal cell, rarely opposite that of first sub-marginal; the sub-costal cross-vein is close by its tip. The first longitudinal vein joins the costa usually a little beyond the middle of the anterior branch of second longitudinal vein; the marginal cross-vein situated about its length distant from the tip of the first longitudinal vein is usually opposite the middle of the anterior branch of the second. The præfurca is moderately long, more or less arcuated at its base. Second sub-marginal cell slightly longer than the first, the petiole of the latter more or less the length of marginal cross-vein; the anterior branch of second longitudinal vein arcuated at its base, then curved gently upwards, and about twice the length of posterior branch which is gently curved downwards. Inner ends of second sub-marginal and discal cells usually opposite one another; the small cross-vein a short distance beyond; in *G. flavipennis* the small cross-vein is extremely small or entirely obsolete so that the inner ends of the second sub-marginal and discal cells form almost a right angle with one another. There are five posterior cells in all but one species, *G. jucunda*, O.-Sacken. The second posterior cell in the former case, varies from one-half to two-thirds the length of the third posterior; the third and fourth posterior cells of equal length or the latter somewhat longer. Discal cell closed, usually not more than twice longer than broad; the great cross-vein usually about opposite its middle, but near its inner end in *G. flavipennis*. Sixth longitudinal vein slightly and seventh distinctly sinuated. The wings (Pl. XXIII., figs. 30-42) more or less completely banded transversely with brown; except for stigma they are immaculate in *G. flavipennis*.

Schiner's *Cloniophora* and Thomson's *Cœnarthria* are *Gynoplistiæ;* the difference in the antennæ being only of specific importance. The species which seem to differ most from the rest are *G. vilis*, Walk., and the extra-Australian *G. jucunda*, O.-Sack.

The *Gynoplistiæ* frequent flowers; their young stages are unknown.

366. GYNOPLISTIA VILIS, Walker. (Pl. XXIII., fig. 30).

Ctenophora vilis, Walk., Ent. Mag. II. p. 469, 1835; *Gynoplistia vilis*, Westwood, Lond. and Edin. Phil. Mag. VI. p. 280, 1835; *G. nervosa*, Westw., Zool. Journ. V. No. 20, p. 447, pl. xxii. figs. 10-11; *G. flavitarsis*. Macquart, Dipt. Exot. 4th Suppl. p. 12, t. 1, fig. 2, 1850; *G. vilis*, Westw., Trans. Ent. Soc. 1881, p. 369, pl. xviii. f. 6.

♂.—Length of antennæ......	0·180 inch	...	4·56 millimètres.
Expanse of wings........	0·410 × 0·100	...	10·41 × 2·54
Size of body..............	0·500 × 0·060	...	12·70 × 1.54
♀.—Length of antennæ......	0·090 inch	...	2·27 millimètres.
Expanse of wings........	0·410 × 0·100	...	10·41 × 2·54
Size of body..............	0·520 × 0·060	...	13·20 × 1·54

Head with a greyish or yellowish-grey bloom; rostrum, palpi and antennæ black or deep brown, the first joint of palpi and first five (sometimes only the two basal) joints of antennæ testaceous; the antennæ 18- or 19-jointed in both sexes; in ♂ the first 14 or 15 flagellar joints rather elongate with a long branch, last two or three branches becoming shorter; the remaining two or three joints sub-cylindrical; in ♀ the first 11 or 12 flagellar joints with very short sub-equal branches, the last two or three branches usually very short, terminal joint elongate, cylindrical; in both sexes the first three branches directed outwards. Thorax with a greyish or yellowish-grey bloom (the ground-colour deep brown or black), with more or less distinct traces of three brown or brownish longitudinal stripes meeting in front of suture; a lateral brown stripe from anterior margin to origin of wings; pleuræ with a grey bloom. Halteres ochreous-yellow with infuscated club. Abdomen brown, sometimes deep brown; the second to fourth segments more or less deeply bordered anteriorly, and all the

segments slightly laterally, with ochreous; sometimes the fifth segment, or even also the third and fourth, entirely ochreous or brownish-ochreous; venter brownish-ochreous or brownish, sometimes the last segment entirely dark brown; ♂ forceps ochreous-brown or light brown, armed with two outer movable, and one inner fixed, claw-like appendages (Pl. xxiv., fig. 65); ovipositor ochreous-brown, more or less reddish, upper valves elongated, slightly curved, lower valves shorter. Coxæ fulvous or light brown, covered with a grey bloom. Femora somewhat obscure fulvous or testaceous, with a broad black ring at apex; genua pale; tibiæ obscure fulvous or testaceous at basal half, gradually darkening into black towards apex; tarsi black, in the hind feet the metatarsal joints ochreous-yellow, with a black ring at the apex.* Wings with a brownish tint, with two dark brown spots; first spot small, squarish, at origin of second longitudinal vein, the second running obliquely from costa (at stigma, which it envelopes) to small cross-vein or the inner end of discal cell; veins dark brown. Auxiliary vein reaching costa opposite or beyond inner end of second sub-marginal cell; sub-costal cross-vein a little before its tip, obliquely situated; marginal cross-vein indistinct (owing to stigma) situated a distance equal to twice its length from tip of first longitudinal; tip of first longitudinal vein opposite middle of anterior branch of second longitudinal; præfurca a little arcuated at its base, straight, tolerably long; petiole of first sub-marginal cell short, about half the length of stigma; anterior branch of second longitudinal almost straight, reaching costa nearly mid-way between tip of first longitudinal and that of posterior branch of second longitudinal; the latter branch slightly arcuated posteriorly towards its tip; second posterior cell two-thirds the length of third posterior; discal cell longer than wide, the great cross-vein at or rather beyond its middle; seventh longitudinal vein sinuated.

Hab.—Tasmania (Macquart); Sydney and other localities in N.S.W. (Masters and Skuse). Three ♂ and three ♀ specimens.

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* Macquart says "les deux premiers articles des postérieurs d'un jaune pâle."

367. GYNOPLISTIA CYANEA, Westwood. (Pl. XXIII., fig. 31).

Gynoplistia cyanea, Westw., Lond. and Edin. Phil. Mag. VI. p. 280, 1835; Macquart, S. à B. II. Suppl. p. 649; Westw., Trans. Ent. Soc. III. p. 370, 1881.

♀.—Length of antennæ......	0·125 inch	...	3·16 millimètres.
Expanse of wings........	0·430 × 0·120	...	10·92 × 3·04
Size of body..............	0·500 × 0·075	..	12·70 × 1·89

Head black, with a reflection which is almost imperceptibly bluish. Rostrum, palpi and antennæ brown; the latter 2- + 17-jointed; flagellar joints 1-8 with a short obtuse branch, the branches gradually diminishing in length, that on the eighth flagellar joint very short; the next joint with a very small projection on inner side; remaining eight joints elliptical, gradually becoming narrower. Collare dark brown. Thorax black, somewhat shining; pleuræ and coxæ pruinose; scutellum and metanotum dark brown, nearly black. Halteres brown, stem lighter. Abdomen deep violaceous, the first two or three segments with a brownish tinge, shining; ovipositor brown. Trochanters, femora and tibiæ obscure testaceous-brown, fuscous at the apex; tarsi fuscous. Wings with a brownish tint, and all the veins clouded; tinted with testaceous-brown between first longitudinal vein and costa (except at extreme base); and having two fuscous sub-costal spots; a small one at base of second longitudinal vein, and a larger one from inner end of stigma to inner end of discal cell; veins and stigma fuscous. Auxiliary vein reaching costa slightly before inner end of second sub-marginal cell; sub-costal cross-vein situated immediately before tip; marginal cross-vein scarcely discernible, situated a little before tip of first longitudinal vein; petiole of first sub-marginal cell extremely short; posterior branch of second longitudinal vein arcuated upwards at the tip; second posterior cell $\frac{2}{3}$ the length of third posterior cell; small cross-vein less than half the length of basal portion of third longitudinal vein; great cross-vein situated immediately before middle of discal cell.

Hab.—New Holland (Westwood) ; Tasmania (Masters).

Obs.—I have no doubt that the above-described is the ♀ of *G. cyanea*, Westw. Westwood states that this species appears to be very closely allied to *Limnophila metallica*, Sch., but the latter is a very different insect as can be seen both from Dr. Schiner's and my description. It would be interesting to know if the male has the three first branches of the flagellar joints directed outwards; Westwood places this species in the same section with *G. vilis*.

368. Gynoplistia obscurivena, sp.n. (Pl. xxiii., fig. 32).

♀.—Length of antennæ......	0.090 inch	...	2·27 millimètres.
Expanse of wings........	0·380 × 0·100	...	9·64 × 2·54
Size of body....	0·460 × 0·060	...	11.70 × 1·54

Head black, somewhat shining, densely clothed with black hairs; rostrum, palpi, and antennæ black, the latter 19-jointed; first 9 flagellar joints with a short branch, the first and last one or two shorter; tenth flagellar joint sometimes with a slight projection on inner side; remaining seven joints sub-elliptical, the terminal one more elongate. Collare dark brown. Thorax black, shining; pleuræ and coxæ with a greyish bloom. Halteres brown or black. Abdomen shining violaceous, incisions of the first two or three segments sometimes tinged with, or even the second to fifth segments entirely reddish-fulvous; ovipositor entirely reddish-fulvous, the valves slender, slightly arcuated. Legs black, the femora reddish-fulvous, with a broad ring of black (more than ⅓ the length of femora) at apex. Wings yellowish at base, with three brownish spots, the apex of wing and all the veins infuscated with paler brownish; first spot filling basal ends of basal cells, the second oblong, enveloping basal half of præfurca and not quite reaching posteriorly to fourth longitudinal, third cloud irregularly roundish, extending from costa (at stigma) to inner end of discal cell; costal cell brown; apex of wing clouded from inner end of second posterior cell; veins dark brown.

Auxiliary vein reaching costa opposite inner end of second sub-marginal cell; sub-costal cross-vein near its tip; marginal cross-vein rather indistinct, about its length distant from tip of first longitudinal vein; præfurca moderately long, arcuated at its origin; petiole of first sub-marginal cell very short; anterior branch of second longitudinal vein usually slightly sinuose, about half the length of posterior branch, reaching costa beyond tip of first longitudinal a distance about half the length of stigma; posterior branch arcuated slightly upwards at the extreme tip; second posterior cell more than half the length of third posterior; discal cell longer than wide, the great cross-vein opposite its middle; seventh longitudinal vein sinuated.

Hab.—New South Wales (Masters). Three specimens.

Obs.—Closely allied to *G. cyanea*, but easily distinguished by the wing-markings, etc.

369. Gynoplistia bella, Walker. (Pl. xxiii., fig. 33).

Ctenophora bella, Walk., Ent. Mag. II., p. 470, 1835; *Gynoplistia bella*, Westwood, Lond. and Edin. Phil. Mag. VI. p. 280, 1835; *G. variegata*, Westw., Zool. Journ. V. No. 20, 448, pl. xxii., figs. 12, 13; Macquart, Dipt. Exot. I. p. 44, t. iii. f. 1a, 1838; Suppl. i. p. 10, 1846, t. i. f. 5; *Variegata gymnoplistioïdes*, Bigot, Ann. Soc. Ent. Fr. 1884, p. 456. *Gynoplistia elegans*, Walk., Ins. Saund. i. Dipt. p. 447, 1856; *G. variegata* Schiner, "Novara" Exp. Dipt. 1868, p. 39; *G. bella*, Westw., Trans. Ent Soc. Lond. 1881, p. 370.

♂.—Length of antennæ......	0·120 inch	...	3·04 millimètres
Expanse of wings........	0·330 × 0·090	...	8·37 × 2·27
Size of body	0·360 × 0·060	...	9·14 × 1·54
♀.—Length of antennæ......	0·110 inch	...	2·79 millimètres.
Expanse of wings........	0·440 × 0·120	...	11·17 × 3·04
Size of body..............	0·440 × 0·090	...	11·17 × 2·27

Head black, somewhat shining, clothed with black hairs; rostrum, palpi, and antennæ black, the two basal joints of the latter sometimes fulvous; ♂ antennæ 18- or 19-jointed, the first 13 or 14 flagellar joints* with long branches, decreasing in length from eighth or ninth joint, the fourteenth, when present, a mere tooth; last three or four joints elongate-elliptical, the terminal one usually elongate-cylindrical; ♀ 17- or 18-jointed, the first 9 or 10 flagellar joints with short branches, decreasing in length from sixth or seventh joint, the tenth, when present, very rudimentary; last five or six joints more or less elliptical, the terminal one usually elongate; in both sexes the first two branches directed outwards. Thorax deep black, slightly shining, with three longitudinal narrow stripes of greyish-yellow bloom or microscopic pubescence (visible only at a certain obliquity) from anterior border to transverse suture, also two large distinct sub-triangular yellow spots of similar character to stripes immediately below the humeri; pleuræ and coxæ with a grey, almost hoary, bloom. Halteres black. Abdomen reddish-fulvous, the first and last two or three segments deep black; genitalia reddish-fulvous; ♂ forceps (Pl. xxiv., fig. 66) armed with a single, somewhat hooked, appendage; ♀ ovipositor rather long, slightly curved. Coxæ and tarsi deep black; femora fulvous or reddish-fulvous, with a broad ring of black at the apex; tibiæ black, the basal half (except a ring of black at base), more or less fulvous or reddish-fulvous. Wings slightly tinted with yellowish, the basal portions more fulvous (but black at the origin), with three blackish (in fresh specimens) or dark brown equidistant, irregular fasciæ, and the costal cell and apex (from inner end of second posterior cell) clouded with a somewhat lighter blackish or brown, the posterior margin slightly clouded with greyish; the first fascia not nearer base of wing than humeral cross-vein, sometimes interrupted in the axillary cell and at posterior margin, connected to next fascia by a vitta filling the intervening portion of anal

*Sometimes the fifteenth flagellar joint also has a very rudimentary tooth of a branch.

cell; second fascia of about equal width to first, from origin of second longitudinal to tip of seventh longitudinal, subject to more or less complete interruptions in both the basal cells and at posterior margin, and connected to third fascia by a vitta more or less completely filling upper half of intervening portion of second basal cell; third fascia a little broader than the others, extending from costa, at stigma, across discal cell, to lower extremity of great cross-vein; the centre of discal cell usually clear. Auxiliary vein reaching costa opposite or somewhat beyond inner end of second sub-marginal cell (sometimes opposite inner end of first sub-marginal); sub-costal cross-vein near its tip; marginal cross-vein indistinct, about twice its length distant from tip of first longitudinal and joining anterior branch of second longitudinal vein at the middle; præfurca nearly straight, moderately long, arcuated or even angulated at its origin; petiole of first sub-marginal cell very short, sometimes less than length of marginal cross-vein; anterior branch of second longitudinal vein considerably arcuated at its base, about half the length of posterior branch, reaching costa beyond tip of first longitudinal a distance equal to about half the length of stigma; posterior branch arcuated slightly upwards at the extreme tip; second posterior cell somewhat more than half the length of third posterior; discal cell longer than wide, the great cross-vein opposite its middle; sixth longitudinal vein slightly and seventh distinctly sinuated.

Hab.—Apparently generally distributed in Australia. Common.

Var. β.—Two ♂ specimens have the apex of wings only slightly infuscated; the forceps and last two abdominal segments black; and the tibiæ brown with the base and apical half black.

Hab.—Tasmania (Masters).

Var. γ,—A ♀ specimen has only the first and last abdominal segments black, and black tibiæ.

Hab.— King George's Sound, Western Australia (Masters).

Var. δ.—A ♂ specimen has the forceps and next preceding segment black, and the hind tibiæ brown at base and apex.

Hab.—King George's Sound (Masters).

Obs.—I have found this species most abundant about Sydney from August to November. There are more than one hundred specimens before me for comparison.

370. Gynoplistia Westwoodi, sp.n. (Pl. xxiii. fig. 34).

♀.—Length of antennæ......	0·135 inch	...	3·42 millimètres.
Expanse of wings........	0·520 × 0·140	...	13·20 × 3·35
Size of body..............	0·500 × 0·090	...	12·70 × 2·27

Head black, somewhat shining, with black hairs; rostrum, palpi, and antennæ black, the first basal joint of latter sometimes brownish; the antennæ 18- or 19-jointed, the first 10 or 11 flagellar joints with short branches, decreasing in length from seventh or eighth joint, the eleventh, when present, a mere tooth; first two branches directed outwards; last six joints more or less elliptical, the terminal one usually elongate. Thorax black, shining; pleuræ and coxæ with a greyish or greyish-yellow bloom, the latter covering a brownish-fulvous spot mid-way between origin of wings and collare. Halteres brownish, with a black club. Abdomen reddish-fulvous, the first segment and last three violaceous-black, also violaceous-black spots laterally on the third to fifth segments; ovipositor entirely reddish-fulvous, the valves long, slightly curved. Coxæ and tarsi black; femora and tibiæ fulvous or reddish-fulvous, with a ring of black at the apex (that on the former the broader). Wings with a slightly yellowish tint, the basal portion fulvous, with three brown equidistant spots or abbreviate fasciæ, also the costal cell tinted with yellow or very pale brownish, and the apex of wing (from inner end of second posterior cell); fourth (except anterior branches) to seventh longitudinal vein, and both ends of discal cell and great cross-vein, more or less infuscated with brownish; generally distinct cloud-streaks about middle of sixth and seventh longitudinal veins; first wing-spot filling basal portions of the two basal cells, second squarish, filling portion of first basal cell at origin of

second longitudinal, third the largest, irregularly rounded, extending from costa (at stigma) to inner end of discal cell. Auxiliary vein opposite or somewhat beyond inner end of second sub-marginal cell, sub-costal cross-vein near its tip; marginal cross-vein indistinct, about its length distant from tip of first longitudinal vein and opposite middle of anterior branch of second longitudinal vein; præfurca arcuated at the base, moderately long; petiole of first sub-marginal cell very short, rather longer than marginal cross-vein; anterior branch of second longitudinal vein arcuated at the base, somewhat sinuated, usually less than half the length of posterior branch, joining costa beyond tip of first longitudinal a distance about equal to length of great cross-vein; posterior branch slightly arcuated upwards at extreme tip; second posterior cell more than half the length of third; discal cell longer than wide, the great cross-vein situated before its middle; sixth longitudinal vein slightly and seventh distinctly sinuated.

Hab.—New South Wales (Masters and Skuse). Five specimens.

Obs.—This species is undoubtedly distinct from *G. bella*, to which however it is nearly related. At first glance it can easily be distinguished from *G. bella* by its larger size, less distinctly marked wings, and fulvous tibiæ. The male is unknown to me.

371. GYNOPLISTIA HOWENSIS, sp.n. (Pl. XXIII. fig. 35).

♀.—Length of antennæ......	0·090 inch	..	2·27 millimètres.
Expanse of wings.......	0·350 × 0·090	...	8·87 × 1·27
Size of body.............	0·400 × 0·050	...	10·16 × 1·27

Head very deep metallic blue; rostrum, palpi and antennæ black, the base of rostrum and first two or three antennal joints testaceous-yellow; antennæ 16-jointed, the first 7 flagellar joints with short sub-equal branches, the following two with rudimentary ones; first two branches directed outwards; last five

joints sub-elliptical, the terminal one elongate, twice the length of the penultimate joint. Thorax testaceous or light yellowish-brown, somewhat shining; pleuræ with a grey bloom. Halteres ochreous, the club black. Abdomen deep violaceous-black, with the first two segments testaceous; ovipositor entirely ochreous or light testaceous, the valves slender, slightly curved. Coxæ and femora testaceous, the latter with a black ring at apex; genua pale; tibiæ and tarsi black. Wings with a very pale yellowish tint, more yellow at the base, with a spot and two fasciæ of brown (all equidistant), also costal cell and apex of wing (from inner end of second posterior cell) clouded with brown; the spot filling bases of the basal cells; first fascia extending from origin of second longitudinal to tip of seventh longitudinal vein, interrupted only in the second basal cell; second fascia entire, extending from costa, at stigma, to posterior margin at fifth longitudinal vein; veins dark brown. Auxiliary vein reaching costa opposite inner end of first sub-marginal cell; sub-costal cross-vein opposite inner end of second sub-marginal cell; first longitudinal vein terminating in costa about mid-may between tips of auxiliary vein and anterior branch of second longitudinal; marginal cross-vein indistinct, short, about twice its length distant from tip of first longitudinal, and opposite the middle of anterior branch of second longitudinal vein; præfurca angulated at its origin, of moderate length; petiole of first sub-marginal cell very short; anterior branch of second longitudinal vein angulated at its base, sinuated, about half the length of posterior branch; second posterior cell half the length of the third posterior; discal cell somewhat longer than wide, the great cross-vein at its inner end; sixth longitudinal vein slightly and seventh distinctly sinuated.

Hab.—Lord Howe Island. One specimen.

Obs.—The specimen from which this species is described was, amongst other Diptera, etc., when collected, unfortunately placed in spirit instead of being pinned at once, hence it has greatly suffered in appearance and probably some of the colours have been altered.

372. GYNOPLISTIA MELANOPYGA, Schiner. (Pl. XXIII. fig. 36).

Gynoplistia melanopyga (♂), Sch., Dipt. 'Novara' Exp. Zool. Theil, Bd. ii. p. 39, 1868.

♂.—Length of antennæ......	0·120 inch	...	3·04 millimètres.
Expanse of wings........	0·350 × 0·090	...	8·87 × 2·27
Size of body..............	0·420 × 0·060	...	10·66 × 1·54

Head shining black, with black hairs; rostrum, palpi and antennæ black; the latter 19- or 20-jointed; the first 12 or 13 flagellar joints with long branches, decreasing in length from the ninth or tenth joint, the thirteenth, when present, a mere rudimentary tooth; last five joints sub-elliptical, the terminal one usually more elongate; the first two branches directed outwards. Thorax black, shining; pleuræ and coxæ with a grey or yellowish-grey bloom. Halteres brown with a black club. Abdomen reddish-fulvous; the first segment and last two or three, including forceps, violaceous-black (the apex of basal pieces of latter slightly reddish-brown); forceps armed with a single, somewhat thick, slightly bent appendage, tridentate at the extremity, and some peculiar appendages of the internal apparatus (Pl. XXIV., fig. 67). Coxæ, tibiæ and tarsi black, except that the hind tibiæ are brownish-fulvous, with a slight black ring at base and a broad one at apex, sometimes also the fore and intermediate pair; femora reddish-fulvous, with a ring of black at apex. Wings with a pale brownish tint, fulvous at base, the apex, costal cell and the posterior veins slightly infuscated; three brown spots; first spot filling bases of basal cells; second squarish, usually slightly smaller than the first, situated at origin of second longitudinal vein; third larger, somewhat roundish, extending from costa, at stigma, to inner end of discal cell. Auxiliary vein reaching costa almost opposite inner end of first sub-marginal cell; sub-costal cross-vein near its tip; first longitudinal reaching costa at a point more than midway between tips of auxiliary vein and anterior branch of second longitudinal vein; marginal cross-vein

rather more than its length distant from tip of first longitudinal and at middle of anterior branch of second longitudinal vein; præfurca moderately long, nearly straight, slightly arcuated at its extreme base; petiole of first sub-marginal cell very short; anterior branch of second longitudinal vein arcuated at its base, very slightly sinuose, about half the length of posterior branch; the latter arcuated upwards at its extreme tip; second posterior cell more than half the length of third posterior; discal cell longer than wide, the great cross-vein situated at middle of its length; sixth longitudinal vein very slightly, and seventh distinctly sinuated.

Hab.—Sydney ("Novara" Exp.); ten specimens (Masters and Skuse).

373. Gynoplistia punctipennis, Westwood.

Gynoplistia punctipennis, Westw., Ann. Soc. Ent. Fr. IV. p. 682, 1835; Trans. Ent. Soc. III. p. 371, 1881.

♀.—"Capite et thorace cinereis; hujus dorso fusco, angulis humeralibus utrinque puncto nigricanti; abdomine fœm. obscure fusco, elongato, stylo rufescenti; alis limpidis, costa tenui, maculisque nonnullis parvis (ad conjunctionem venarum transversarum) alteraque stigmaticali majori fuscis; pedibus longioribus subtestaceis; femoribus tibiisque ad apicem fuscis, tarsorum articulis 2-4 albidis; antennis fœm. fuscis, basi pallidioribus, 16?-articulatis, articulis 3-8 interne acute productis, vix ramosis. Long. corp. 7 lin. Exp. alar. 12 lin.

Hab.—Nova Hollandia. In Mus. Hopeiano Oxoniæ."

374. Gynoplistia bimaculata, sp.n. (Pl. xxiii., fig. 37).

♂.—Length of antennæ......	0·150 inch	...	3·81 millimètres.
Expanse of wings........	0·360 × 0·100	...	9·16 × 2·54
Size of body...............	0·380 × 0·060	...	9·64 × 1·54

Head black, somewhat shining, with black hairs; rostrum, palpi, and antennæ black, the latter 20-jointed; first 12 flagellar

joints with long branches, the last three or four branches a little decreasing in length; first two branches directed outwards; the last six joints elliptical, the terminal one narrow, elongate, cylindrical. Thorax black, shining, with yellowish hairs; pleuræ with greyish or yellowish-grey bloom. Halteres brown with black club. Abdomen reddish-brown (or mahogany colour) with a slightly cupreous appearance, densely clothed with yellowish pubescence, the first segment deep violaceous-black; forceps (Pl. XXIV., fig. 68) concolorous with rest of abdomen, armed with a single claw-shaped appendage. Coxæ black, with a hoary bloom. Femora fulvous or reddish-fulvous, with a broad ring of deep brown or black at the apex; tibiæ obscure testaceous, deep brown at extreme base and (more so) at the tip; tarsi deep brown. Wings with a pale brownish tint owing principally to cloudings on nearly all the veins; marked with two brown spots; costal cell and apex of wing pale brownish; first brown spot squarish, situated at origin of second longitudinal vein, the second larger, extending from costa, at stigma, to inner end of discal cell; veins dark brown. Auxiliary vein reaching costa opposite inner end of second sub-marginal cell; sub-costal cross-vein near its tip; marginal cross-vein situated rather more than its length distant from the tip of first longitudinal vein, and opposite middle of anterior branch of second longitudinal vein; præfurca moderately long, obtusely arcuated at its origin; petiole of first sub-marginal cell short, anterior branch of second longitudinal vein arcuated at its base, and gently bending upwards to the costa, about half the length of posterior branch; the latter bending gently downwards, arcuated upwards at its extreme tip; second posterior cell about two-thirds the length of third posterior; discal cell longer than wide, the great cross-vein at or beyond its middle; sixth longitudinal vein slightly and seventh distinctly sinuated.

Hab.—Berrima, N.S.W. Three specimens.

375. Gynoplistia flavipennis, sp.n. (Pl. xxiii., fig. 38).

♂—Length of antennæ......	0·130 inch	..	3·30 millimètres.
Expanse of wings........	0·350 × 0·090	...	8·87 × 2·27
Size of body..............	0·440 × 0·060	...	11·17 × 1·54
♀.—Length of antennæ......	0·120 inch	...	3·04 millimètres.
Expanse of wings........	0·420 × 0·100	...	10·66 × 2·54
Size of body	0·440 × 0 060	...	11·17 × 1·54

Head shining, black, slightly violaceous, with short brownish hairs; rostrum, palpi, and antennæ brown or blackish, the rostrum and first two or three antennal joints more or less brownish-ochreous or even dull testaceous-yellow; ♂ antennæ 19- or 20-jointed, the first 13 flagellar joints with long branches, the last four or five branches decreasing in length; last four or five joints more or less elliptical; in ♀ 18-jointed, the first 10 flagellar joints with short branches, the tenth a mere tooth; remaining six joints more or less elliptical, the terminal one elongate; in both sexes the first two branches directed outwards. Collare deep brown. Thorax black, levigate, with yellowish hairs; scutellum brown; metanotum violaceous-black; pleuræ with a hoary bloom. Halteres brownish-ochreous. Abdomen testaceous to light reddish-brown, shining, the first segment and genital organs deep violaceous-black, the ♀ ovipositor sometimes more brown; ♂ forceps smaller than in *G. bimaculata*, and the terminal claw-shaped appendages more slender and more hooked (Pl. xxiv., fig. 69); ♀ ovipositor slightly curved. Coxæ black, with hoary bloom; trochanters fulvous; femora fulvous, ringed (broadly in hind pair) with brown at the apex; tibiæ obscure testaceous or yellowish-brown, infuscated at the apex; tarsi brown. Wings pellucid, with a pale yellow tint, the origin of præfurca and inner ends of sub-marginal cell sometimes indistinctly infuscated; stigma distinct, rather elongated, brownish; veins dark brown. Auxiliary vein reaching costa opposite middle of petiole of first sub-marginal cell; sub-costal cross-vein near its tip; marginal cross-vein situated rather more than

its length distant from tip of first longitudinal vein and considerably before middle of anterior branch of second longitudinal vein; præfurca moderately long, obtusely arcuated or angulated at its origin; petiole of first sub-marginal cell short, usually longer than marginal cross-vein; anterior branch of second longitudinal vein almost angulated at its base, and bending gently upwards to costa; small cross-vein extremely short or obsolete, so that the discal cell is in contact with second sub-marginal, and forms rather more than a right angle; discal cell nearly twice as long as wide, the great cross-vein near its inner end; sixth longitudinal vein slightly and seventh distinctly sinuated.

Hab.—Upper Hunter, N.S.W. (Masters). Seven specimens.

Obs.—Easily distinguished from all other species by its spotless wings. A very distinct species, evidently most allied to the last, *G. bimaculata.*

376. GYNOPLISTIA VIRIDIS, Westwood. (Pl. XXIII. fig. 39).

Gynoplistia viridis, Westw., Lond. and Edin. Phil. Mag. 1835 (?); Macquart, Dipt. Exot. I. p. 44, pl. 3, f. 1, 1838; *Cœnarthria viridis*, Thomson, Dipt. 'Eugenia' Exp. p. 446, pl. 9, f. 1, 1868.

♂.—Length of antennæ......	0·100 inch	...	2·54 millimètres.
Expanse of wings........	0·250 × 0·070	...	6·34 × 1·77
Size of body:.............	0·270 × 0·050	...	6·85 × 1·27

Head æneous-green, nitidous. Rostrum, palpi, and antennæ brown, the latter 16-jointed; joints of scapus sometimes obscure testaceous; first 10 flagellar joints with a simple branch, the last three branches diminishing in length; eleventh usually with a slight projection, sometimes also twelfth, more rarely the eleventh with even a short branch; first two branches directed outwards; terminal joints elliptical, about equal in length. Thorax æneous-green, slightly chalybeous anteriorly, nitidous; pleuræ griseo-pruinose. Halteres fulvous-yellow. Abdomen reddish-ochraceous,

the first and last three segments (including genitalia) violaceous-black, cupreous; sub-nitidous, sub-glabrous (Pl. XXIV. fig. 70, forceps). Coxæ griseo-pruinose. Femora and tibiæ fulvous, with a short ring of obscure fuscous at apex; tarsi obscure fuscous; metatarsal joint usually brownish towards base. Wings pellucid, somewhat yellowish, especially at base, more or less tinted with very pale brownish on basal half; with one indistinct and two distinct fuscous spots; first filling inner ends of the basal cells, second, a small squarish spot at origin of second longitudinal vein; the third larger, extending from costa to inner end of discal cell; fifth longitudinal vein infuscated; veins and stigma fuscous. Auxiliary vein appearing to either reach costa or first longitudinal vein slightly before inner end of second sub-marginal cell; sub-costal cross-vein blurred, situated immediately before tip; marginal cross-vein indistinct or scarcely visible, short, situated a little before tip of first longitudinal vein; anterior branch of second longitudinal vein angulated near its base; præfurca rather angulated at its origin; petiole of first sub-marginal cell short; second sub-marginal cell very little longer than first posterior cell; second posterior cell not half the length of third posterior cell; small cross-vein not half the length of basal portion of third longitudinal vein; great cross-vein joining at or immediately before middle of discal cell.

Hab.—Sydney (Eugenia Exp.); Sydney and Tasmania (Masters). Four specimens.

Var. β. Abdomen with first two and last four abdominal segments violaceous-black. Legs entirely obscure fuscous, except rather more than basal half of femora fulvous. Basal half of wing not so distinctly tinted with pale brownish; the two costal spots more distinct, and with a third oblong paler one filling basal portion of the two basal cells. In other respects exactly like the above.

Hab.—Blue Mountains, N.S.W. (Masters). One specimen.

Obs. 1. Macquart attaches Westwood's name to the above, but this latter author does not even refer to this species in his sum-

mary of Exotic Tipulidæ (Trans. Ent. Soc. Lond. 1881, p. 363). I have not seen Westwood's original description; there may be some mistake. However, from careful comparison of specimens with Macquart's and Thomson's descriptions, I cannot help concluding that both refer to the same species. Thomson himself notices the great resemblance of his species to *G. viridis*, Westw., with which he compares it.

Obs. 2. The above-described is undoubtedly *Cœnarthria viridis*, Thoms. The species has no claims to be separated from *Gynoplistia*.

Obs. 3. Macquart gives the description of the ♀ of *G. viridis*, Westw., which corresponds with an old damaged specimen of this sex before me, obtained by Mr. Masters in Tasmania. The lateral borders of the segments are dark coppery, and the ovipositor is fulvous. The male does not differ from Sydney specimens.

B. *Tibiæ with a pale ring.*

377. Gynoplistia annulata, Westwood. (Pl. xxiii. fig. 40).

G. annulata, Westw., Lond. and Edin. Phil. Mag. VI. p. 280, 1835; Macquart, S. à B. II. Suppl. p. 650; Westw., Trans. Ent. Soc. III. p. 371, 1881, pl. xviii. fig. 7; O.-Sacken, Mon. Dipt. N. Amer. IV. p. 329, 1869; Studies, II., p. 211, 1887.

♀.—Length of antennæ......	0·110 inch	...	2·79 millimètres.
Expanse of wings........	0·420 × 0·140	...	10·66 × 3·55
Size of body..............	0·420 × 0·085	...	10 66 × 2·14

Head black. Rostrum, palpi, and antennæ dark brown, the latter 17-jointed; flagellar joints 1-9 with a short obtuse branch, gradually becoming longer to the fifth or sixth joint, from thence diminishing in length; tenth joint with a small projection on the inner side; first two branches directed almost outwards; terminal joint elongate, more than twice the length of the one next before it, appearing as if made up of three compressed joints. Entire

thorax, coxæ, and trochanters fulvous, opaque. Halteres black. Abdomen black, densely covered (sparingly on venter and first superior segment) with very pale yellowish sericeous hairs; ovipositor brown. Legs brown; tibiæ ringed with white in the middle, the ring on the fore pair narrow and somewhat blurred; tarsi with the first joint fulvous at the base. Wings fuscous; veins brown; stigma slightly darker than wing-membrane. Auxiliary vein joining first longitudinal vein opposite inner end of second sub-marginal cell; marginal cross-vein situated about midway between tip of auxiliary vein and tip of first longitudinal; inner end of first sub-marginal cell immediately beyond inner end of second sub-marginal; small cross-vein nearly half the length of basal portion of third longitudinal vein; second posterior cell rather more than half the length of third posterior; great cross-vein joining at middle of discal cell.

Hab.—Near Sydney, N.S.W. (Masters). A single specimen.

Obs.—Westwood described the above as a N. American insect, and Baron Osten-Sacken (Mon. Dipt. N. Amer. I. p. 13, 1862), doubted the probability that the locality given was the correct one. The describer points out that "the label attached to the type specimen in the Oxford Museum is in the hand writing of Mr. Hope, and is clearly written N.A." Since the insect has only been found in Australia we must conclude that Hope meant N. Australia and not N. America by the letters on the label.

378. GYNOPLISTIA MACQUARTI, sp. n.

Gynoplistia Macquarti n.nov. for *G. cyanea (præoc.)* Macquart, Dipt. Exot. 4th Suppl. p. 13, 1850.

"♀.—*Cyanea nitida. Pedibus nigris; femoribus basi rufis; tibiis posticis annulo albo. Alis fusco-maculatis.*"

Body of a blackish violet-blue, shining, with slight green reflections. Rostrum, proboscis, palpi and antennæ black. Pleuræ with a white down. Abdomen with tawny oviduct.

Femora with anterior half tawny; the yellowish-white ring of the posterior tibiæ situated a little beyond the middle. Halteres tawny. Wings clear, with two spots and extremity brown; the spots to exterior margin, the first at base of marginal vein, not extending beyond the externo-median; the second at base of submarginal vein, extending to the discoidal cell; the cross-veins slightly bordered with brown; the venation as in *G. variegata* (*G. bella*, Walk.). Long. 5 × 1.

Hab.—Tasmania.

Obs.—I am compelled to re-name this species, *cyanea* having been used by Westwood for another species in 1835. The above (judging by descriptions only) seems to much resemble *G. apicalis*, Walk., from the same locality.

379. Gynoplistia viridithorax, sp.n. (Pl. xxiii., fig. 41).

♀.—Length of antennæ......	0·100 inch	...	2·54 millimètres.
Expanse of wings........	0·380 × 0·110	...	9·64 × 2·79
Size of body.....	0·440 × 0·070	...	11·17 × 1·77

Head deep metallic shining green; sparsely clothed with short hairs; rostrum, palpi and antennæ black; the latter 17-jointed; first 8 flagellar joints with short branches, first two directed not quite outwards, the last one a mere tooth; next six joints elliptical; the terminal joint elongate. Thorax deep metallic shining green, with slight bluish reflections; pleuræ with an oblique hoary stripe, directed to intermediate coxæ; scutellum tinged with brown. Halteres testaceous-brown. Abdomen rather dark reddish-fulvous, shining, almost cupreous; the first two segments entirely, and the following five more or less distinctly bordered laterally with violaceous-blue; ovipositor concolorous with abdomen, the valves long, slightly curved. Coxæ black, hoary; trochanters brown; femora fulvous or testaceous, more or less brownish at apex; tibiæ brown, paler at base, and becoming black towards apex, with a whitish or pale yellowish ring just beyond middle; tarsi black. Wings subhyaline, with a very pale yellowish tint, and two brown spots;

first spot small, square, at origin of second longitudinal vein, the second an abbreviated irregular fascia, extending from costa, between tips of auxiliary and first longitudinal veins (where it is broadest), to lower end of a small cross-vein; veins black or deep brown; the veins closing each end of discal cell and the great cross-vein slightly infuscated. Auxiliary vein reaching costa beyond inner end of second sub-marginal cell; sub-costal cross-vein near its tip; marginal cross-vein almost invisible, situated about twice its length distant from tip of first longitudinal vein, and opposite one-third the length of anterior branch of second longitudinal; præfurca obtusely angulated at its origin, the remainder straight; petiole of first sub-marginal cell short, as long as great cross-vein; anterior branch of second longitudinal vein a little arcuated at its base, gently curved upwards, half the length of posterior branch; the latter almost straight, slightly arcuated upwards at its extreme tip; second posterior cell two-thirds the length of the third posterior; discal cell longer than wide, the great cross-vein about opposite its middle; sixth longitudinal vein slightly and seventh considerably sinuated.

Hab.—Moonbar, Monaro, N.S.W., 3-3500 feet (Helms). March; *one specimen in Coll. Australian Museum.*

380. Gynoplistia apicalis, Walker.

Gynoplistia apicalis, Saund. MSS. In Ins. Saund. by Walker, Vol. I. Dipt. p. 447, 1856.

"♂ and ♀.—*Nigro-cyanea; antennæ et pedes nigra; pectus albidum; abdomen apice luteum; femora basi lutea; tibiæ posticæ albo fasciatæ; alæ limpidæ, fasciis fuscis, venis nigris basi luteis; halteres testacei.*"

"Blackish blue. Antennæ and legs black. Pectus whitish. Abdomen luteous at the tip. Femora luteous towards the base; hind tibiæ with a white band. Wings limpid, with three dark brown spots along the costa, and with two paler brown spots in

the disk; tips brown; veins black, luteous at the base. Halteres testaceous. Length of the body, 4-4½ lines; of the wings, 10 lines.

"Van Diemen's Land."

381. Gynoplistia fumipennis, Walker.

Gynoplistia fumipennis, Saund. MSS. In Ins. Saund. by Walker, Vol. I. Dipt. p. 448, 1856.

"♀. *Atra; pectus canescens; femora basi testacea; tibiæ posticæ fascia subapicali alba; alæ nigricantes.*"

"Deep black. Pectus somewhat hoary. Femora testaceous towards the base; hind tibiæ with a white band towards the tip. Wings blackish; veins black. Length of the body, 5 lines; of the wings, 9 lines."

"Van Diemen's Land."

382. Gynoplistia chalybeia, sp.n. (Pl. xxiii., fig. 42).

♂.—Length of antennæ......	0·075 inch	..	1·89 millimètres.
Expanse of wings........	0·210 × 0·055	...	5·33 × 1·39
Size of body..............	0·210 × 0·040	..	5·33 × 1·01

Head deep metallic shining blue, clothed at the back with black hairs; rostrum, palpi and antennæ black; the latter 16-jointed; first 10 flagellar joints with tolerably long branches; first two branches directed outwards; the last three decreasing in length; next three simple joints sub-elliptical; the terminal joint cylindrical. Thorax deep metallic shining blue; pleuræ with a hoary bloom. Halteres light fulvous. Abdomen deep shining violaceous-blue; forceps black. Legs black; femora fulvous for less than the basal half; hind tibiæ with a broad whitish ring just beyond the middle. Wings hyaline, with three spots; the costal cell and apex of wing clouded with brown, also a small faint greyish clouding in anal angle, another larger between tip of seventh longitudinal and the fifth longitudinal vein, and a third filling basal

half of fifth posterior cell and extending along the cross-veins; the first brown spot filling basal portion of the two basal cells, second about equal to last, at origin of second longitudinal vein; the third the largest, roundish, extending from costa, at stigma, to discal cell; veins deep brown or black. Auxiliary vein reaching costa about opposite inner end of second sub-marginal cell; sub-costal cross-vein close to its tip; marginal cross-vein indistinct, about its length distant from tip of first longitudinal vein and opposite middle of anterior branch of second longitudinal; præfurca obtusely angulated at its origin, running in one straight line with the petiole and posterior branch of second sub-marginal cell; the latter petiole very short, equal to marginal cross-vein; anterior branch of second longitudinal angulated at its origin, about half the length of posterior branch and almost as long as præfurca; posterior branch slightly arcuated upwards at its extreme tip; second posterior cell rather shorter than the third; discal cell rather longer than wide, the great cross-vein somewhat before its inner end; sixth longitudinal vein slightly and seventh distinctly arcuated.

Hab.—Mount Kosciusko, N.S.W., 5000 ft. (Helms). March; *one specimen in Coll. Australian Museum.*

Obs.—Differs from *G. Macquarti* and *G. apicalis* principally in being only half the size, and the abdomen not being fulvous at the extremity; apparently most like *G. apicalis* as regards wing-spots.

Genus 24. Cerozodia, Westwood.

Cerozodia, Westw., Lond. and Edin. Phil. Mag. VI. p. 281, 1835; *Ozocera*, Westw., Zool. Journ. V. p. 449, pl. xxii. f. 5, antennæ (nec *Ozodicera*, Macq.); *Cerozodia*, Westw. Trans. Ent. Soc. Lond. 1881, p. 379; Osten-Sacken, Studies II. p. 211, 1887.

"*Limnobiæ* affinis. Alarum venæ ut in *Gynoplistia nervosa* * (fig. 10) depositæ. Antennæ, thorace longiores 32-articulatæ;

* *Gynoplistia vilis*, Walk.

articulis 3tio ad 31mum ramulum longissimum gracilem pilosum e basi emittentibus (fig. 5); oculi maris maximi interne lunati, subtus fere conniventes. Palpi perbreves 3-articulati, articulo 1mo minuto, 2do majore subovato, 3tio paullo majori, spatuliformi. Thorax ovato-rotundatus. Abdomen maris longum cylindricum, unguibus duobus terminatum" (Westwood).

"Rostrum not longer than the head; palpi rather long (Westwood says: palpi perbreves?); as far as I can see, the last joint is not longer than the others. Thorax small compared to the length of the abdomen; the latter narrow, of equal breadth, very slightly broader at the forceps; the forceps seem to have the same structure as in *Gynoplistia*. Legs comparatively stout; tibiæ with spurs; empodia present. Wings: venation like that of *Gynoplistia*, with the exception in the course of the auxiliary vein (which ends in the first vein); first sub-marginal cell rather long, its proximal end but little distant from proximal end of the second sub-marginal; the second posterior with a long petiole; the great cross-vein near the middle of the discal cell" (Osten-Sacken).

Obs.—This form is quite unknown to me. Baron Osten-Sacken has seen the two original specimens from which the above was drawn, enumerates additional characters of the genus, and moreover describes another species (Studies II. p. 213) from New Zealand. In a ♂ specimen of the latter in the possession of Baron Osten-Sacken the antennæ are 39-jointed, whilst in another of the same sex in the Berlin Museum the antennæ are 36-jointed. Towards the tip of the antennæ the branches and joints both seem to be liable to modifications similar to those observed amongst the closely allied *Gynoplistiæ*.

383. Cerozodia interrupta, Westwood.

Cerozodia interrupta, Westw., Lond. and Edin. Phil. Mag. VI. p. 281, 1835; Zool. Journ. V. p. 449, pl. xxii. fig. 5, antenna, 1835; Trans. Ent. Soc. Lond. 1881, p. 379, pl. xix. f. 13; Osten-Sacken, Studies II. p. 213, 1887.

"Pallida, ochracea, thorace sub-obscuriore; oculis nigris; antennarum ramulis pallide fuscis; alis pallidis venis sub-fuscis, linea gracili interrupta cinerea per areolam elongatam sub-costalem currente" ("this means the first basal cell," Osten-Sacken).

Hab.—Swan River, Western Australia. Hopean Mus. Oxford.

Obs.—Length 21 mm.; the number of antennal joints is 32 (Osten-Sacken).

Section V. ANISOMERINA.

"Two sub-marginal cells (only one in *Cladolipes*); three, four, or five posterior cells; discal cell closed or open; sub-costal cross-vein near the tip of the auxiliary vein, posterior to the origin of the second vein. Eyes glabrous. *The normal number of the antennal joints is six in the male and not more than ten in the female.* Tibiæ with spurs at the tip; empodia distinct; ungues generally smooth." (Osten-Sacken.)

Obs.—This section embraces only four genera, *Anisomera*, Meig., *Cladolipes*, Loew, *Penthoptera*, Schiner, *Eriocera*, Macq.; the first three occur in Europe and N. America, and the last one predominates in tropical America, Asia, and Africa. No Australian examples have yet been recorded.

Section VI. AMALOPINA.

"Two sub-marginal cells; four or five posterior cells; discal cell closed or open; *sub-costal cross-vein far removed from the tip of the auxiliary vein and anterior to the origin of the second longitudinal vein.* Tibiæ with spurs at the tip; empodia distinct. Eyes pubescent; front usually with a more or less distinct gibbosity. Normal number of antennal joints *sixteen* or *thirteen.*" (Osten-Sacken).

Six genera belong here. Four of these are common to Europe and America, and two are known only in N. America; and besides the European and American representatives of this section, the

two species of *Amalopis* hereafter described are the only examples that have been recorded from any other country. The genera fall into three groups, distinguished by the number of antennal joints supported by peculiarities of alar-venation.

Genus 25. AMALOPIS, Haliday.

Amalopis, Hal., in Ins. Brit. Dipt. p. xv. 1856; *Bophrosia* (ex parte), Rondani, Prod. I. p. 183, 1856; *Crunobia*, Kolenati, Wien. Ent. Mon. IV. p. 391, 1860; (?) *Nasiterna*, Wallengren, Ent. Tidskr. Stockh. pp. 179 and 191, 1881; *Amalopis*, O.-Sacken, Mon. Dipt. N. Amer. IV. p. 260, pl. 2, f. 15 (wing), pl. 4, f. 30 (genitalia), 1869; Studies, II. p. 224, 1887.

"Two sub-marginal cells; five posterior cells; discal cell generally present, sometimes wanting; the sub-costal cross-vein is more or less anterior to the origin of the second longitudinal vein; the second sub-marginal cell is never longer (usually distinctly shorter) than the first posterior cell; the tip of the wing is rounded in both sexes (not sinuate posteriorly as in *Pedicia*). Tibiæ with spurs at the tip; empodia distinct; ungues smooth. Eyes pubescent; front with a gibbosity behind the antennæ; the latter 16-jointed, short (not reaching much behind the collare when bent backwards). Male forceps more or less club-shaped, with stout, branched horny appendages." (Osten-Sacken.)

Obs.—The length of the fourth posterior cell and position of the great cross-vein in *A. nigritarsis* seem peculiar; also the præfurca is unusually short.

384. AMALOPIS NIGRITARSIS, sp.n.

♂.—Length of antennæ	0·050 inch	...	1·27 millimètres.
Expanse of wings	0·380 × 0·090	...	9·64 × 2·27
Size of body	0·320 × 0·040	...	8·12 × 1·01
♀.—Length of antennæ	0·050 inch	...	1·27 millimètres.
Expanse of wings	0·500 × 0·120	...	12·70 × 3·04
Size of body	0·440 × 0·060	...	11·17 × 1·54

Head greyish-brown: rostrum palpi, and antennæ brown or blackish, the two basal joints of latter sometimes ochreous; first flagellar joint somewhat elongate, the rest globose to elliptical; extremely short verticils. Collare ochreous, tinged with brown. Thorax ochreous, dull, with three broad black stripes; intermediate stripe reaching suture; posterior portion of thorax, with scutellum and metanotum, with a greyish bloom, usually somewhat infuscated with brownish; pleuræ somewhat tinged with brown, and having a greyish bloom. Halteres ochreous, the club infuscated. Abdomen dusky dull brown, sparingly sprinkled with yellowish pubescence, sometimes the margins of segments tinged with reddish-ochreous; venter also more or less tinged with same; genitalia ochreous or reddish-ochreous; ♂ forceps apparently something like those of *A. inconstans* (Mon. Dipt. N. Amer. Pl. IV. fig. 30), but there is a distinct anal style, and the pair of small horny appendages *(h)* seem to be wanting; ♀ ovipositor rather short, somewhat curved, the upper and lower valves about equal in length. Coxæ, femora and tibiæ fulvous; the latter two with a black ring at the apex, the tibiæ also slightly infuscated, sometimes entirely brownish; tarsi black. Wings slightly tinted with yellowish or pale brownish, fulvous at the the base; pale greyish clouds (sometimes scarcely perceptible) at origin of præfurca, bases of sub-marginal cells and on the cross-veins; stigma elongate, pale brownish; veins brown or blackish, the auxiliary vein somewhat fulvous. Auxiliary vein reaching costa opposite the tip of fifth longitudinal vein; sub-costal cross-vein situated before origin of præfurca a distance equal to more than twice the length of great cross-vein; marginal cross-vein its length distant from tip of first longitudinal vein; præfurca short, originating considerably beyond the middle of the wing, more or less arcuated, usually a little more than half the length of anterior branch of second longitudinal; second sub-marginal cell a little shorter than the first (in one instance both of equal length, their inner ends and small cross-vein meeting at one point); small cross-vein joining petiole of second sub-marginal cell at varying points; discal cell elongate, as long or longer than third basal

cell, usually closed, sometimes opened posteriorly; great cross-vein joining exactly at inner end of fourth posterior cell which is close up to inner end of discal cell; sixth and seventh longitudinal veins almost straight.

Hab.—Sydney (Masters & Skuse); Mount Kosciusko (4-5000 ft.), N.S.W. (Helms); *one specimen in Coll. Australian Museum.* September to March.

Obs.—Apparently distinct from *A. congrua*, Walk. Six specimens only before me.

385. AMALOPIS CONGRUA, Walker.

Limnobia congrua, Walk., List Dipt. Brit. Mus. I. p. 42, 1848; *Amalopis congrua*, O.-Sacken, Mon. Dipt. N. Amer. IV. p. 264, 1869.

"*Fulva, thorace fusco trivittato, abdomine fusco fasciato, antennis fuscis, pedibus fulvis, coxis femoribusque basi pallidis, alis subfulvis.*

"Body tawny; eyes bronze colour; feelers and palpi brown, the former yellow at the base; chest with three brown stripes, the middle one broad and long; hind borders of the segments of the abdomen brown, and this colour occupies the whole of the segments towards the tip, except the last, which, with its appendages, is bright tawny; legs dull tawny; hips and base of the thighs pale tawny; wings with a very slight tawny tinge; veins brown; poisers whitish-yellow, their knobs darker. Length of of the body, 4 lines; of the wings, 9 lines.

Hab.—Swan River, W. Australia.

Obs.—Unknown to me.

EXPLANATION OF PLATES.

Plate XXI.

Fig. 1. Wing of *Dicranomyia punctipennis* (♀).
Fig. 2. ,, ,, *saxatilis* (♀).
Fig. 3. ,, ,, *marina*.
Fig. 4. ,, ,, *remota* (♀).
Fig. 5. ,, ,, *cuneata* (♂).
Fig. 6. ,, *Thrypticomyia aureipennis* (♂)
Fig. 7. ,, *Trochobola australis* (♂).
Fig. 8. ,, *Libnotes strigivena*.
Fig. 9. ,, *Rhamphidia communis*.
Fig. 10. ,, *Orimarga australis*.
Fig. 11. ,, *Leiponeura gracilis*.
Fig. 12. ,, *Rhypholophus (Amphineurus) umbraticus* (♀).
Fig. 13. ,, *Tasiocera tenuicornis* (♂), the veins denuded of hairs.
Fig. 14. ,, *Gnophomyia fascipennis* (♀)

Plate XXII.

Fig. 15. Wing of *Rhabdomastix Osten-Sackeni* (♂).
Fig. 16. ,, *Lechria singularis* (♂).
Fig. 17. ,, *Trentepohlia australasiæ* (♂).
Fig. 18. ,, *Limnophila leucophæata* (♀).
Fig. 19. ,, ,, *obscuripennis*.
Fig. 20. ,, ,, *aureola* (♂).
Fig. 21. ,, ,, *ocellata* (♀).
Fig. 22. ,, ,, *imitatrix*.
Fig. 23. ,, ,, *antiqua*.
Fig. 24. ,, ,, *interventa* (♀)
Fig. 25. ,, ,, *inordinata* (♂).
Fig. 26. ,, ,, *luctuosa* (♀)
Fig. 27. ,, ,, *levidensis* (♂).
Fig. 28. ,, ,, *Lawsonensis* (♀).

Plate XXIII.

Fig. 29. Wing of *Limnophila australasiæ*.
Fig. 30. ,, *Gynoplistia vilis*.
Fig. 31. ,, ,, *cyanea* (♀).
Fig. 32. ,, ,, *obscurivena* (♀).
Fig. 33. ,, ,, *bella*.
Fig. 34. ,, ,, *Westwoodi* (♀).

PLATE XXIII.—*continued*:—

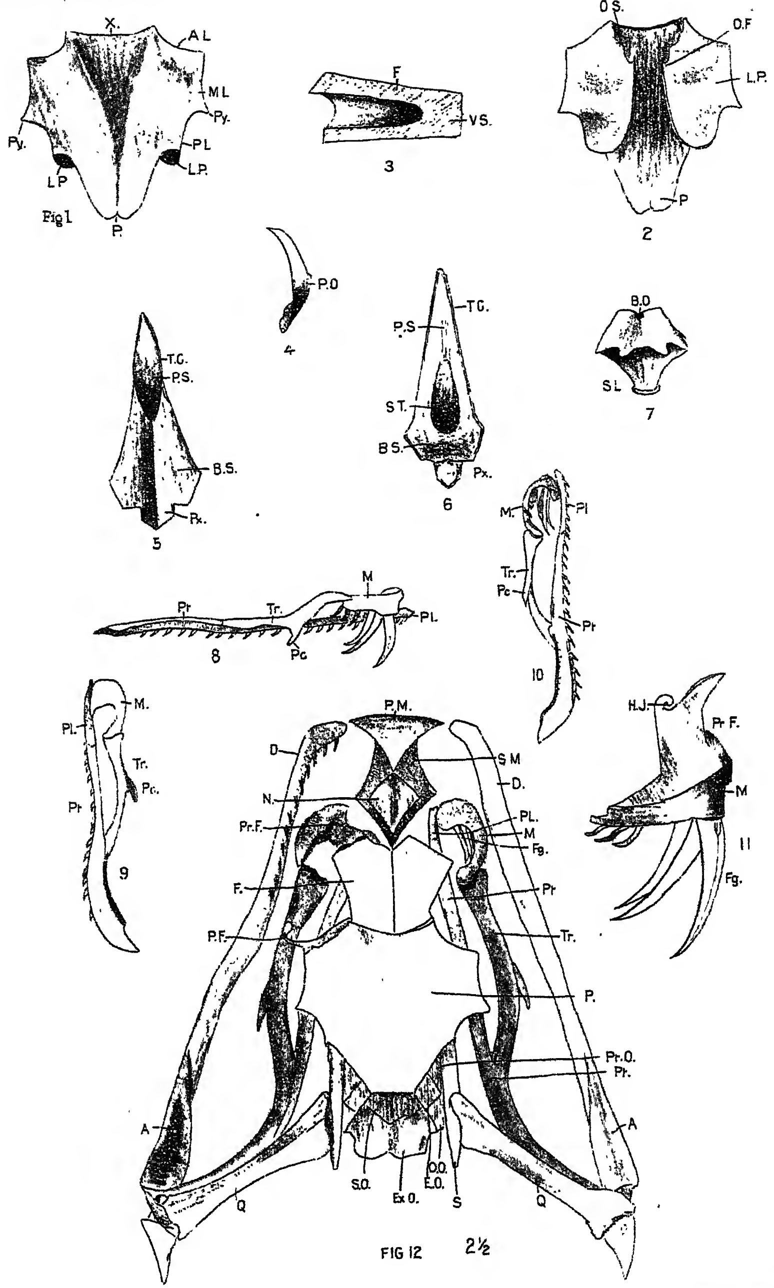
Fig. 35. Wing of *Gynoplistia Howensis* (♀).
Fig. 36. ,, ,, *melanopyga* (♂).
Fig. 37. ,, ,, *bimaculata* (♂).
Fig. 38. ,, ,, *flavipennis*.
Fig. 39. ,, ,, *viridis* (♂).
Fig. 40. ,, ,, *annulata* (♀).
Fig. 41. ,, ,, *viridithorax* (♀).
Fig. 42. ,, ,, *chalybeia* (♂).

PLATE XXIV.

Fig. 43. Male forceps of *Dicranomyia marina*.
Fig. 44. ,, *Thrypticomyia aureipennis*.
Fig. 45. Portion of antennæ of *Thrypticomyia aureipennis* (♂).
Fig. 46. Labium and palpi of *Geranomyia picta*.
Fig. 47. ,, ,, *lutulenta* and *annulata*.
Fig. 48. ,, ,, *fusca*.
Fig. 49. Male forceps of *Geranomyia picta*.
Fig. 50. ,, ,, *fusca*.
Fig. 51. ,, *Limnobia bidentata*.
Fig. 52. ,, *Trochobola australis*.
Fig. 53. Palpus of *Leiponeura brevivena*.
Fig. 54. Antenna of *Leiponeura brevivena*.
Fig. 55. One-half of a male forceps of *Tasiocera gracilicornis*.
Fig. 56. Antenna of *Tasiocera gracilicornis*.
Fig. 57. Male forceps of *Rhabdomastix Osten-Sackeni*.
Fig. 58. ,, *Lechria singularis*.
Fig. 59. ,, *Trentepohlia australasiæ*.
Fig. 60. Mouth-parts of *Conosia irrorata*; *aa*, palpi.
Fig. 61. Antenna of *Conosia irrorata*.
Fig. 62. One half of male forceps of *Conosia irrorata*.
Fig. 63. Male forceps of *Limnophila antiqua*.
Fig. 64. ,, ,, *australasiæ*.
Fig. 65. One-half of male forceps of *Gynoplistia vilis*
Fig. 66. Male forceps of *Gynoplistia bella*.
Fig. 67. ,, ,, *melanopyga*.
Fig. 68. ,, ,, *bimaculata*.
Fig. 69. ,, ,, *flavipennis*.
Fig. 70. ,, ,, *viridis*.

Obs.—For full terminology of venation, male forceps, etc., see Mon. Dipt. N. Amer., IV., 1869, pp. 26-35, by Baron O.-Sacken.

Note.—All the figures drawn to the same scale, irrespective of their natural size.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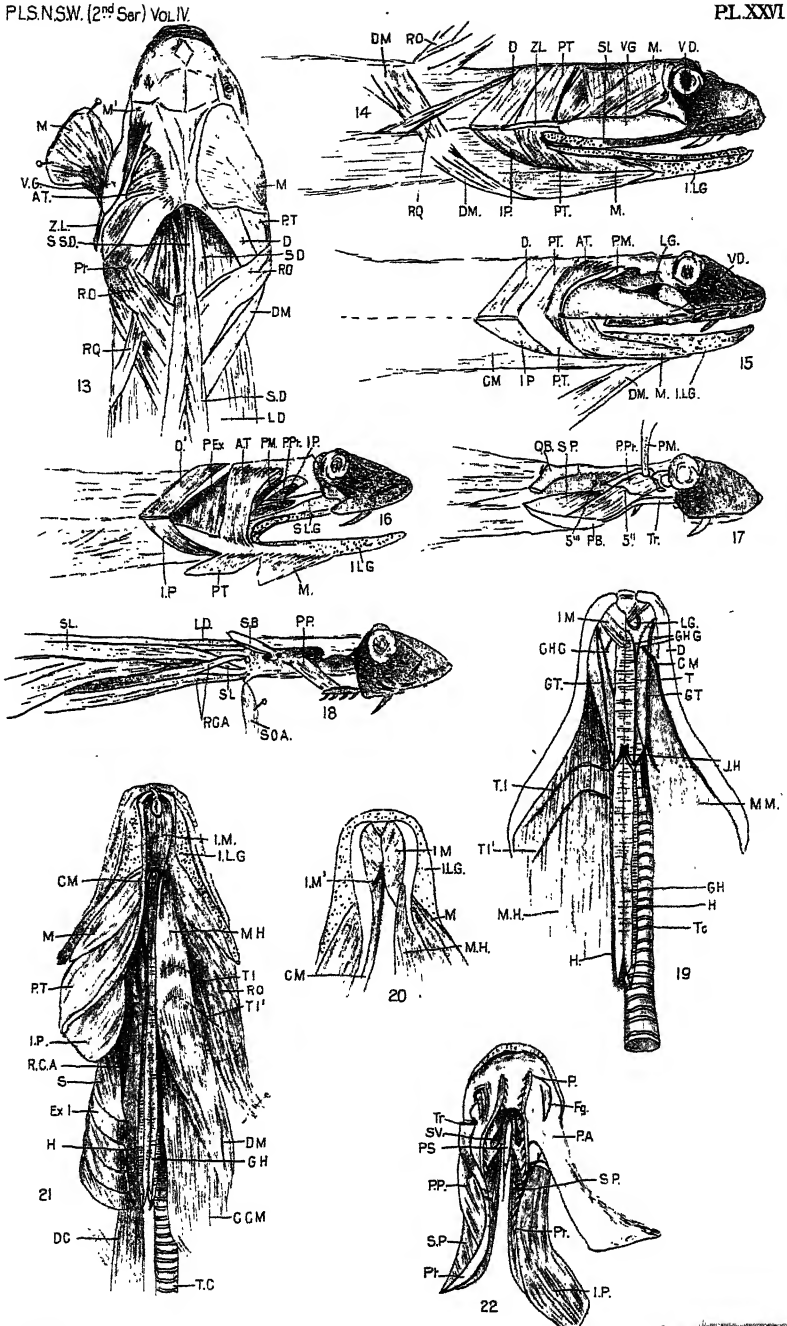
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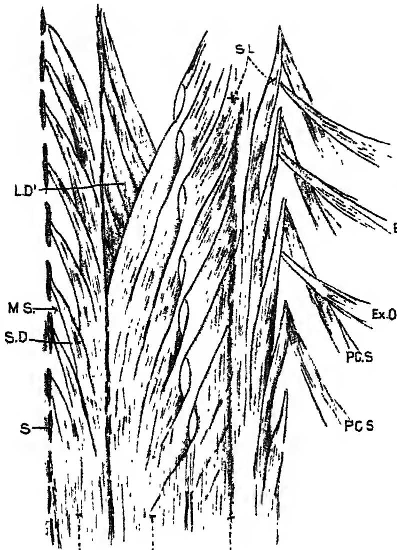

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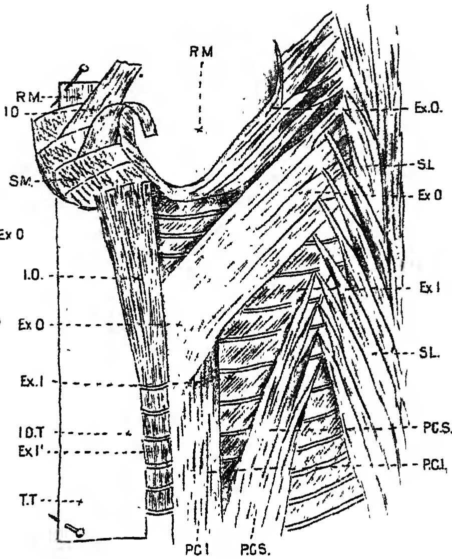

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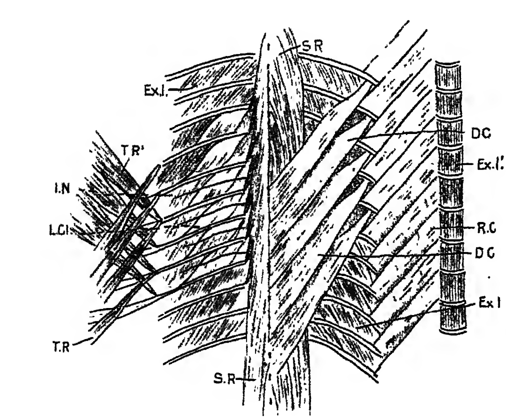

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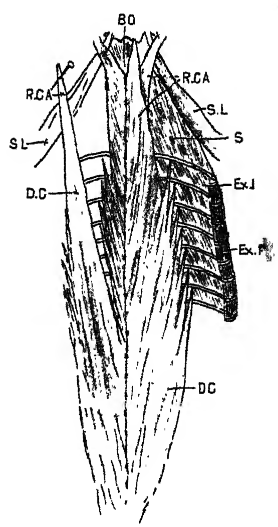

26

W.J.M.

THE OSTEOLOGY AND MYOLOGY OF THE DEATH ADDER *(ACANTHOPHIS ANTARCTICA).*

By W. J. McKay, B.Sc.

(Plates xxv.-xxvii).

The observations contained in this paper were made in the Biological Laboratory of the Sydney University, through the kindness of Dr. Haswell, whom I have to thank for having suggested the subject, and for aiding me by his advice. I have likewise to thank Mr. James Wilson, M.B., also of the University, for his assistance regarding the homology of certain of the muscles. Lastly I am much indebted to the Trustees of the Australian Museum, and to Mr. Douglas Ogilby for supplying me with many specimens.

My first object in studying the Death Adder was to ascertain if there were any grounds for considering it to be a viper. On referring to the literature on the bones and muscles of the Ophidia, I saw that there was ample room for a paper on both, for while the bones of the head have been examined by many observers, none so far as I could ascertain had described them with reference to the exact position of the muscular attachments.

With regard to the muscles of the head and body, I found that there had been few observers; and that almost no work had been done as regards morphology. I therefore determined to apply the ideas put forward by Humphry in his admirable papers on Morphology, and endeavour to throw some light on the homology of the various muscles.

Of the observers who have written on the muscles of the snake D'Alton appears to me to be the most accurate. The latest work is

by Hoffmann, whose descriptions are however only paraphrases of the fuller ones given by D'Alton. Cuvier, Home, Huebner, Meckel, Dugès, Duvernoy, Owen, R. Jones, Teutleben, have all contributed something; Duvernoy particularly has given an admirable description of the muscles of the head in many snakes.

I have endeavoured in the case of each muscle to find its homologue, and where I am doubtful I have retained the name by which the muscle is usually known. I have discarded the use of compound descriptive titles where possible; for I consider that while they may convey a notion of the position of the muscle, they are of little use if they do not at the same time throw light upon the homology of the part.

I have dissected several snakes for comparison, among them being *Pseudechis porphyriacus*, *Diemenia superciliosa*, *Morelia spilotes*, *Daboia Russelli* (?).* In addition to these, several lizards, *Hinulia*, *Grammatophora*, &c., and I made a special dissection of a specimen of *Hydrosaurus varius*. For some points in connection with the muscles of the head, I dissected a few birds, while in addition to these I was constantly engaged in dissecting the human body. Lastly I have dealt with the vertebræ and their various movements, and have devoted considerable time to the study of the mechanism of the jaws.

OSTEOLOGY.—*Bones of the Skull.*

OS PARIETALE.

Os Parietale, D'Alton, Cuvier, Gegenbaur, Hallmann, Harting, Hoffmann, Huxley, Meckel, Joh. Müller, Owen, Parker, Parker, and Bettany, Rathke, Stannius, Wiedersheim.

The parietal consists of a horizontal and two lateral vertical plates. The horizontal plate is an irregular octagon broader anteriorly than posteriorly. It consists of the two moieties of the parietal that have coalesced along the mid-line, but there is no sign of a suture remaining. The anterior border is concave and bevelled

* I am in some doubt if the snake dissected was a *Daboia*; it was certainly a viper.

from before backwards and downwards for articulation with the frontals. The antero-lateral border is concave and smooth, the superior portion of the postorbital articulating with it. The middle lateral border is rounded and smooth, the masseter gliding over it. The postero-lateral border runs backwards and inwards. It has a small tubercle dividing it into an anterior third and a posterior two-thirds. The parieto-pterygoid muscle arises in part from the anterior third, while the anterior temporal arises from the posterior two-thirds. The anterior extremity of the squamosal abuts against the tubercle. The posterior border is the smaller, and is formed like the anterior of the right and left moieties of the parietal. It is serrated for articulation with the supraoccipital.

The superior surface of the parietal taken as a whole is convex. It may be divided for convenience of description into three triangles, a median and two lateral.

The median triangle has its base at the anterior border, and its apex in the mid-line on the posterior border. This triangle is subcutaneous and concave anteriorly. A dark line is seen in the mid-line, indicating where the two halves have coalesced. In *Python* a prominent crest may be seen. The greater development of the crest being, as in the Carnivora, for the attachment of the powerful muscles of the mandible, the muscles being much more powerful in these snakes which have to rely on strength, and not on their poison, for self-defence, and for obtaining their prey.

On either side of the median triangle lies a lateral one. The base of each lateral triangle is irregular, and consists of an antero- and middle- lateral side. The apex is the posterior border. The lateral triangles present a series of concave and convex surfaces. From the inner portion of the triangle the masseter arises, from the outer portion the anterior temporal, and part of the parieto-pterygoid.

Where the middle lateral joins the postero-lateral border a well marked prominence of bone is developed, and from this and a portion of the superior surface the parieto-mandibular muscle arises.

The inferior surface presents four concavities, an anterior pair for the cerebral hemispheres, and a posterior pair for the optic lobes. Posteriorly the surface is much bevelled from behind, downwards and forwards, so as to rest on the supraoccipital and epiotic bones.

The *lateral plates* of the parietal run downwards and inwards; both plates begin above at about the junction of the anterior with the antero-lateral edge, and run back as far as the tubercle on the postero-lateral edge.

The external surface presents anteriorly a deep concavity which contains the lachrymal gland and a part of the orbit; and posteriorly another concavity from the upper part of which the parieto-palatine muscle arises, and from the lower portion the spheno-vomerine. A well marked ridge separates these concavities, and to this is attached the fascia covering in the lachrymal gland. The ridge if followed up is seen to end in the prominent projection above, and to this is attached a band of fascia covering the poison gland. The internal surface of the lateral plate is concave for the optic lobes. The anterior border is irregular, with splints of bone for articulation with the frontal and orbitosphenoid. A semi-circular excavation represents the posterior portion of the optic foramen. The posterior border is triangular in outline; it is rough for articulation with the prootic.

The inferior border is bevelled from above downwards and outwards, for articulation with the basisphenoid. The parietal articulates with the frontals, posterbitals, squamosals, prootics, epiotics, supraoccipital, basisphenoids, and orbitosphenoids.

The parietal differs from the bone of *Python* in not having a median ridge; it differs from all the forms examined in having the well marked lateral process.

OS FRONTALE.

Os Frontale, all authors.

The frontal bones are not anchylosed to one another. Each presents a horizontal and a lateral plate. The horizontal plate is

quadrilateral, the antero-posterior being larger than the lateral axis. The anterior border runs from within outwards and backwards. Where the internal two-thirds joins the external third, a peculiar process of bone projects which fits into a niche in the premaxilla, which will be more particularly described later on. The external third is concave, and forms portion of the supraorbital ridge. The posterior border is convex and articulates with the parietal; it has, however, no connection with the postorbital as in *Python*. This border is bevelled from before downwards and backwards, and fits in between the under portion of the anterior edge of the temporal and of the anterior edge of the lateral plate; thus a firm schindylesis is formed. The internal edge joins its fellow of the opposite side in the mid-line, a distinct frontal suture marking the junction. Anteriorly a plate of bone projects downwards vertically and meets the lateral plate in the mid-line. Thus by the two sides joining, a vertical septum of bone is formed, which separates portion of the cerebral hemispheres. The superior surface is quadrilateral, convex and subcutaneous. The lateral part of this bone consists of a plate that runs from the middle of the inferior surface downwards and inwards, meeting its fellow of the opposite side in the mid-line, where they lie on the parasphenoid. The external surface of the lateral plate is concave and smooth, and joins with the orbitosphenoid and the anterior portion of the lateral plate of the parietal to form the large orbital fossa for the eye and lachrymal gland. A notch in the posterior border of the lateral plate is portion of the optic foramen.

The frontal articulates with the parietal, parasphenoid, orbitsphenoid, premaxilla, and nasal bones.

Os Post-frontale vel Post-orbitale.

Zygomaticum vel Frontale posterius, D'Alton; *Frontale posterius*, Cuvier, Harting, Stannius; *Post-frontale vel Post-orbitale*, Gegenbaur, Parker, Parker and Bettany; *Post-frontale*, Huxley, Hoffmann, Wiedersheim; *Schuppe des Schlafbeins*, Meckel; *Frontale posterius vel Orbitale posterius*, Joh. Müller, Owen.

The postorbital is a semilunar-shaped bone. The upper half of the external surface gives attachment to the subcutaneous tissue which supports the orbital scales; the lower half becomes twisted on itself so that it comes to be posterior. To this is attached a process of the fascia enveloping the poison gland. The upper half of the internal surface is excavated for articulation with the antero-lateral edge of the parietal; inferiorly the surface comes to be anteriorly. The superior extremity does not articulate with the frontal as in *Python*, while the inferior approaches very near to the transverse bone. This bone forms the posterior portion of the orbital margin, but does not appear to be united to the transverse bone by ligament as it is in *Python*. Its chief difference from that of the non-venomous snakes is in its superior extremity non-articulating with the frontal.

Os Nasale.

Os Nasale, all authors.

The nasals consist of two bones. Each presents a horizontal and a vertical portion. The horizontal portion is a thin plate of bone triangular in outline. Its superior surface is convex, smooth, and subcutaneous. The inferior surface is concave and forms portion of the roof of the nasal canal. The anterior border is concave and gives attachment to the olfactory capsule. The posterior border also gives attachment to the same capsule. The internal edge is ill-defined being continuous with the vertical plate. The vertical plate is a thin leaf of bone that meets its fellow of the opposite side in the mid-line. They are not anchylosed together. Posteriorly the septum formed by the two bones runs back to articulate by a pointed extremity with the frontals, while anteriorly they articulate with the premaxilla; and inferiorly they rest between the angle formed by the olfactory cartilages and the nasal septum. These bones do not differ much in shape from the bones of *Python*, but in their relations they are quite dissimilar.

In *Python* the posterior border articulates throughout its whole length with the prefrontal, while here we see that it has no

connection whatever with the prefrontal. In *Pseudechis* there is a slight connection between the two bones, but in *Daboia* there is no other connection than by the membrane that bridges over the space left between the two bones. It is plain from the above arrangement that the prefrontal has a much more extended range of movement in the venomous forms than in the non-venomous.

Os Præmaxillare.

Intermaxillare, D'Alton, Cuvier, Harting; *Præmaxillare*, Gegenbaur, Huxley, Owen, Hoffmann, Parker, Parker and Bettany, Wiedersheim; *Zwischen Kiefer*, Stannius, Meckel.

The premaxilla is a T-shaped bone. The superior surface is smooth and convex, and runs upwards and backwards to form a nasal process which articulates with the vertical septum of the nasals. The inferior surface is horizontal and forms the anterior portion of the roof of the mouth. Posteriorly it is continued back to form a bifurcated palatine process. Between the inferior and superior surfaces there are small lateral plates to which the septo-maxillary bones are articulated. It contains no teeth.

The bone closely resembles the premaxilla of *Python*, and of other forms examined. The chief difference to be noticed between the bones of the non-venomous and the venomous snakes is the relation of the premaxilla to the maxilla; owing to the latter bone in the non-venomous forms being much longer it approaches close to the premaxilla and is united to it by fibrous tissue.

Os Septo-maxillare.

Ethmoideum, D'Alton, Wiedersheim; *Cornet inférieur*, Cuvier; *Turbinal bone*, Huxley, Owen; *Riechbein*, Leydig, Meckel; *Septo-maxillare*, Parker, Parker and Bettany; *Concha*, Stannius; *Septo-maxillare*, Hoffmann.

The septo-maxillary bones are two small shells on either side of the nasal septum. Each has a small vertical portion and a larger horizontal plate. The horizontal plate is triangular in outline, the

base being posterior, the apex anterior, being joined to the premaxillary. The superior surface is concave, the outer portion bending upwards and inwards. It forms the floor of the nasal cavity. The inferior surface is convex and forms a roof for the nasal gland cavity of the vomer. The vertical portion is close to the septum nasi, and rests on the vertical plate of one of the vomers.

Os Vomer.

Os Vomer, all authors.

The vomers are constituted by two distinct bones, each of which has a vertical and a horizontal plate. The vertical plate of each bone approaches its fellow in the mid-line but is separated by a small amount of tissue. Above the vertical plate is in contact with the septo-maxilla and close to the nasal septum, while posteriorly the parasphenoid articulates with it.

The horizontal portion of the bone is triangular in outline, the base being at the mid-line. The anterior extremity is sharp and approaches close to the palatine process of the premaxilla. The posterior extremity is rounded and fades into the vertical plate.

The middle and external portion is convex below; it runs outwards and curls upwards, its superior surface forming the floor of the nasal gland, whose duct perforates the bone anteriorly. On the inferior surface of the bone the spheno-vomerine muscle is inserted. The nasal gland is contained in a box whose roof is formed by the septo-maxilla, the inner and inferior sides by the vomer, the external side being membranous. "Two small labial cartilages are attached to the duct of each nasal gland" (Parker).

Os Basisphenoideum.

Corpus ossis sphenoidei, D'Alton; *Sphenoideum basilare*, Hoffmann, Hallmann, Harting, Stannius; *Sphenoideum*, Cuvier, Joh. Müller, Owen; *Basisphenoid*, Gegenbaur, Huxley, Parker, Parker and Bettany, Wiedersheim; *Körper des Keilbeinstückes*, Meckel; *Körper des vorderen*, *Körper des hinteren Keilbeins*, Rathke.

Os Parasphenoideum.

Parasphenoid, Huxley, Hoffmann, Parker, Parker and Bettany; *Presphenoid*, Owen.

The basisphenoid and parasphenoid when detached from the skull together make up a triangular-shaped bone, the apex of which is anterior.

The anterior portion of the inferior surface constituted by the parasphenoid is deeply excavated, differing much from the corresponding surface in *Python*, in which there is a very prominent ridge, giving attachment to the dense fascia of the roof of the mouth. On each side of the anterior portion the spheno-vomerine muscles are placed. The unossified trabeculæ can be seen running forward from a point just below the optic foramen in a small groove on either side of the bone and just beneath the inferior portions of the frontals. The trabeculæ when traced forward are seen to "unite underneath the fore part of the frontals and become compressed into a vertical ethmoidal plate passing on into the nasal septum" (Parker). The posterior portion of the inferior surface is convex. A small ridge exists in the mid-line which gives attachment to the strong fascia of the region. On either side of the ridge is an excavated surface from which the spheno-pterygoid muscle arises. In *Python* this portion of the bone is very different. There is a very prominent median ridge, and on either side of the ridge is a large wing-like process which corresponds to the basipterygoid process of Lacertilians. A similar process occurs in *Pseudechis*. It gives origin to the spheno-pterygoid muscle. The superior surface is convex in front, but deeply excavated posteriorly to form a hollow "which contains the pituitary body, a quantity of fibrous tissue, and the internal carotid arteries which pass into it laterally beneath the parietal shelf having previously perforated the basisphenoid" (Parker). "There is a posterior clinoid wall, arching over the hinder part of the pituitary body" (Parker). Posterior to this pituitary fossa the bone is concave to receive the mid-brain. "The anterior

extremity of the parasphenoid becomes compressed and knife-like, wedging in between the hinder ends of the vomers" (Parker).

The posterior extremity of the basisphenoid is broader, and from its middle point a quadrilateral outgrowth of bone springs. This is bevelled from above downwards and backwards, and is overlapped by the inferior surface of the basioccipital. The sides of the basisphenoid are bevelled from above downwards and outwards so as to articulate with the parietal above, and the prootic and alisphenoid. The parasphenoid articulates with the vomers, frontals, and basisphenoid. The basisphenoid with the lateral plates of the parietal, the prootics, basioccipital, parasphenoid, and alisphenoid.

Os Basioccipitale.

Corpus ossis occipitalis, D'Alton, Hallmann ; *Occipitale basilare*, Cuvier, Gegenbaur, Wiedersheim, Hoffmann, Stannius ; *Occipitale basilare vel inferius*, Harting; *Basioccipitale*, Huxley, Parker, Parker and Bettany; *Körper des Hinterhauptstückes*, Meckel; *Occipitale inferius*, Joh. Müller, Owen; *Grundtheil des Hinterhauptbeins*, Rathke.

The basioccipital bone is an irregular hexagon. The anterior border is vertical for articulation with the basisphenoid. The antero-lateral side is rough for articulation with the opisthotic and prootic; it runs outwards and backwards. The postero-lateral runs inwards and backwards, and articulates with the prootic and exoccipital. The posterior border constitutes the lower portion of the occipital condyle; below it is rounded, above it is grooved in the mid-line and bevelled from above downwards and outwards so as to receive the two processes from the exoccipital, which complete the trefoil-shaped condyle. The inferior surface is divided into an anterior and a posterior part by a transverse ridge. The anterior of the two portions has the suboccipital articular muscle attached to it. There are four spines projecting backwards from the ridge between these two portions. The median pair give insertion to the inferior part of the rectus capitis anticus of either side. The lateral pair give attachment to the superior part of the rectus

anticus, which is also inserted on the posterior half of the inferior surface of the bone. The sacro-lumbalis prolonged forward from the dorsal region is also attached to the lateral spines. The superior surface is deeply excavated to receive the medulla. The basi-occipital articulates with the basisphenoid, exoccipital, and prootic.

Os Exoccipitale.

Pars lateralis ossis occipitis, D'Alton; *Occipitalia lateralia*, Cuvier, Gegenbaur, Hallmann, Harting, Joh. Müller, Owen, Stannius, Hoffmann, Wiedersheim; *Exoccipitale*, Huxley, Parker and Bettany, Parker; *Gelenkstück des Hinterhauptbeins*, Meckel; *Schenkel des Hinterhauptbeins*, Rathke.

The exoccipitals are irregularly shaped bones which bound in great part the foramen magnum. Each bone consists of a superior horizontal, and a vertical lateral piece. The upper face of the superior piece is flattened and gives attachment to the spinalis dorsi, complexus, and trachelo-mastoideus. The anterior border articulates with the supraoccipital, the mesial border with its fellow of the opposite side, while the external is raised into a prominent edge to join the opisthotic, and gives attachment to some of the fibres of origin of the digastric muscle. The vertical or lateral plate presents a small tubercle for the attachment of the trachelo-mastoid, while immediately beneath this there is a second tubercle for the superior part of the rectus capitis anticus. The internal surface of this plate is in contact with the medulla. Four foramina may be seen on the surface. The anterior three lie in the same line, and transmit the ninth, tenth, and twelfth nerves; the fourth is placed superiorly and posteriorly, and is the "posterior condyloid foramen" (Parker). The anterior border articulates with the opisthotic, and slightly with the prootic, the inferior with the basioccipital, while the posterior runs downwards and backwards and goes to make up the occipital condyle by being the superior moieties of the trefoil-shaped surface. The foramen magnum is bounded almost entirely by these bones, the basioccipital supplying the lower portion only.

Os Supra-occipitale.

Squama ossis occipitis, D'Alton; *Occipitale superius*, Cuvier, Gegenbaur, Joh. Müller, Owen, Hoffmann, Wiedersheim; *Squama occipitalis*, Hallmann, Stannius; *Occipitale superius vel squama occipitalis*, Harting; *Schuppe des Hinterhauptbeins*, Meckel, Rathke; *Supra-occipitale*, Huxley, Parker, Parker and Bettany.

The supraoccipital is a very small quadrilateral-shaped bone formed by the coalescing of the moieties of the opposite sides at the mid-line; the suture can be made out. The bone runs downwards and backwards. The superior edges are closely joined to the epiotics, while the parietal rests upon them. The inferior edges articulate with the exoccipitals. The posterior surface of the bone gives attachment to the spinalis dorsi. The anterior surface helps to form portion of the cranial roof. In *Python* there is a well marked median ridge, indicating the line of junction of the opposite sides. The bone articulates with the parietal, epiotic, and exoccipital.

Ossa Periotica.

Petrosum, D'Alton, Hallmann, Harting, Müller, Wiedersheim, Rocher, Cuvier; *Felsentheil des Schlafbeins*, Meckel; *Epiotic*, *Prootic*, *Opisthotic*, Huxley, Parker, Parker and Bettany, Hoffmann, Gegenbaur; *Felsenbein*, Rathke; *Ala temporalis*, Stannius.

The periotic bones are covered in part by the anterior portion of the squamosal. On this being removed the three bones are seen united by the characteristic Y-shaped synarthrosis.

The prootic lies anterior to the other bones. It is united superiorly with the epiotic, and superior plate of the parietal, while in front it joins the posterior portion of the lateral plate of that bone. Inferiorly it rests on the basioccipital and basisphenoid, while posteriorly it is in contact with the opisthotic and exoccipital. Its external surface is perforated by the large foramen ovale, and is in relation with the alisphenoid. The fifth nerve issues from the foramen ovale in two divisions, the anterior one

made up of the first and second parts of the nerve emerges in front of the alisphenoid, the posterior division behind. The small foramen for the seventh nerve is slightly posterior to the foramen ovale, while the eighth nerve emerges from a foramen placed close to the junction of the prootic with the epiotic. The bone also forms portion of the anterior boundary of the fenestra ovalis. It has the greater portion of the anterior semicircular canal running upwards and backwards to the epiotic, and it also has the anterior portion of the horizontal canal running forward to join the anterior.

The epiotic is closely united to the supraoccipital bone, and more anteriorly with the superior plate of the parietal. Inferiorly it joins the prootic, posteriorly the opisthotic. It contains the superior parts of the anterior and posterior semicircular canals. Portion of the digastric muscle arises from its external surface.

The opisthotic is in contact with the epiotic above, the prootic in front, the basioccipital below, and the exoccipital behind. It contains the chief part of the posterior semicircular canal which runs upwards and forward to end in the epiotic above. It also has the posterior portion of the horizontal canal running from the prootic in front. "The opisthotic forms the back margin of the fenestra ovalis, and forks in the fenestra rotunda nearly enclosing it" (Parker).

Os Alisphenoideum.

Alisphenoid, Parker, Parker and Bettany, Hoffmann.

The alisphenoid is a small quadrilateral-shaped line. It lies across the foramen ovale, and thus divides this orifice into two moieties. Its anterior border is concave, and forms the posterior rim of the anterior of the two orifices of the foramen ovale which transmits the first and second divisions of the fifth nerve; the posterior border bounds the foramen which transmits the third division. The superior border is joined to the prootic, while the external surface is smooth, and is in contact with the parieto-pterygoid muscle. A small foramen is present in the lower portion of this external surface; this transmits the nerve that

supplies the parieto-pterygoid. The inferior border rests on the basisphenoid below.

Os Orbitosphenoideum.

Orbitosphenoid, Parker, Parker and Bettany, Hoffmann.

The orbitosphenoid is a thin plate of bone only to be distinguished with difficulty from the surrounding bones. It lies on the posterior and external portions of the lateral plate of the frontal, and articulates with the orbital portion of the parietal. It is reniform in outline, the concavity being anterior. The bone helps to form the orbital fossa, and enters by a small process into the formation of the optic foramen.

Os Squamosum.

Mastoideum, D'Alton, Harting, Joh. Müller, Owen; *Squamosum*, Gegenbaur, Huxley, Parker, Parker and Bettany, Wiedersheim, Hoffmann; *Schläfenschuppe*, Hallmann; *Zitzenknochen des Schlafbeins*, Meckel; *Tympanicum vel squamosum*, Rathke; *Squama temporis*, Stannius.

The squamosal is prismatic in outline, and presents superior, external, and internal faces.

The superior face is slightly convex anteriorly, while posteriorly it becomes narrow. The anterior portion gives origin to the posterior temporal, while the posterior portion has part of the digastric arising from it.

The external surface is convex. The anterior half gives origin to the posterior temporal; the posterior half is articulated to the quadrate by a convex facet. In *Python* it is the posterior extremity of the bone that is modified for articulation with the quadrate. The internal surface is broader anteriorly than posteriorly; its anterior two-thirds is concave for articulation with the convex facet in the epiotic. The posterior third projects backwards and portion of the digastric is attached to it. The anterior extremity abuts against the projection mentioned in connection with the postero-lateral border of the parietal.

The bone articulates with the parietal, quadrate, prootic, epiotic, and supraoccipital.

Os Quadratum.

Quadratbein, D'Alton; *Quadratum*, Gegenbaur, Hallmann, Huxley, Joh. Müller, Parker, Hoffmann, Parker and Bettany, Rathke, Wiedersheim; *Quadratum vel Tympanicum*, Owen, Stannius, Cuvier.

The quadrate is a prismatic-shaped bone with two articular extremities. The bone is twisted on its vertical axis from before outwards and backwards. The *external* side commences in a flat oval surface above, and runs downwards and backwards to end below in an external condyle. The posterior temporal muscle arises from the upper three-fourths of the surface. The posterior side commences as a slightly concave surface above, and runs downwards and backwards, and ends below in a flattened surface. The digastric muscle arises from this surface. The internal side begins above as a broad concave surface; it runs downwards and outwards, and inferiorly coming to lie anteriorly, owing to the twisting of the bone. The external pterygoid muscle arises from this surface. There are three edges to the bone. The posterior is the only one that calls for notice. It projects forwards, and curling round forms a concave surface, to the middle of which the columella and the stylohyal are united, and it also serves to give origin to the external pterygoid muscle and the suboccipital articular muscle.

The superior extremity is prismatic in outline. The external and anterior faces are the continuations upwards of the exterior and anterior faces of the shaft of the bone. The internal face is oval, concave from before back, broader anteriorly than posteriorly. It articulates with the facet on the external surface of the squamosal, a small synovial membrane being present. The lower surface is flattened from before backwards, and presents a striking similarity to the inferior extremity of the humerus of the human body. There is a small external and internal condyle, and a trochlear surface. The external condyle is sub-cutaneous. To

the internal is attached the internal pterygoid muscle, and a very strong internal ligament which unites it posteriorly to the articular bone below. The trochlear surface has its axis placed at right angles to the long axis of the head. It is the shape of an hour glass. The exterior portion is smaller and lower than the interior, since the axis of the extremity runs outwards and downwards. Both surfaces are convex from before back, while two surfaces go to make up a concavity from side to side. Each of the trochlear surfaces forms a semicircle, but the radius of the internal is to the radius of the external as two to one. Above the trochlear surface in front is a slight depression which receives the "coronoid" process of the articular.

The quadrate articulates with two bones, the squamosal, and the articular, and is in connection with the columella and stylohyal. This bone differs considerably in shape from the quadrate of *Python*. In the latter it is quadrilateral, and the inferior extremity is even broader than the superior. There is the same evident twist, but the bone is for the most part composed of an internal and external surface. The projection from the columella is also much more marked in *Python*. Comparing the size of the skull of the two snakes, the quadrate of *Acanthophis* is much more powerfully made than in *Morelia* or *Python*. In fact the quadrate is the most stoutly made bone in the head.

THE MANDIBLE.

Os Dentale, Os Angulare, Os Articulare, Harting, Gegenbaur, Hoffmann, Parker, Parker and Bettany, Owen, Wiedersheim. OS DENTALE : *L'os dentaire*, Cuvier ; *Zahnstück*, Meckel ; *Dentale*, Stannius. OS ARTICULARE : *Articulare*, Cuvier, Stannius ; *Gelenkstück*, Meckel. OS CORONIDEUM : *Complementare*, Gegenbaur ; *Kronstück*, Meckel ; *Coronoideum*, Hoffmann, Parker and Bettany, Parker ; *Complementare vel coronoideum*, Stannius ; *Complementare*, Owen. OS SPLENIALE : *Spleniale*, Parker and Bettany, Parker ; *Operculare*, Stannius, Gegenbaur, Owen, Harting, Hoffmann. OS SUPRA-ANGULARE : *Supra-angulare*, Parker and Bettany, Gegen-

baur, Owen, Parker, Wiedersheim; *Complementare*, Harting, Hoffmann.

The mandible is composed of two moities; an anterior single piece or dentary, and a posterior compound piece consisting of splenial, coronoid, angular, surangular, and articular. The shaft of the compound portion is bent so that the external side is convex. It has two surfaces and two borders.

The external surface runs from the dentary back to the extremity of the articular. The anterior two-thirds of it is made up of angular, and is convex; the posterior third of articular, and presents two concave surfaces and a ridge between them which runs from behind downwards and forward. The masseter is attached to the anterior two-fifths of the surface, the posterior temporal to the anterior of the two concave surfaces; between and above these muscles we have the anterior temporal inserted. The lower head of the internal pterygoid arises from the posterior of the two concave surfaces; while on the ridge between these surfaces the mylohyoid is inserted.

The internal surface is concave from before back. Anteriorly the splint-like splenial may be seen running back from the dentary, and expanding joins the coronoid; this lies immediately below the surangular no longer now to be made out as a separate element, though well seen in *Morelia*. From the posterior third of the surface the upper head of the internal pterygoid muscle arises. The middle third is convex and smooth, and over this portion the internal pterygoid glides.

As the superior edge runs back from the alveolar border of the dentary it bifurcates to enclose the large mandibular fossa into which is inserted the external pterygoid muscle. Immediately in front of the fossa the parieto-mandibularis is inserted; immediately behind is placed the sigmoid cavity of the articular, and posterior to this the edge expands into a triangular surface whereon the digastric is inserted, and over the external edge of which the retractor oris glides.

The articular surface bears a resemblance to the greater sigmoid cavity of the ulna. Its axis slopes from above downwards and inwards. A median ridge running back from a small "coronoid"-like process in front divides the cavity into two portions, each of which is concave from before back. The external portion is the smaller though deeper of the two, and serves to prevent the too ready dislocation of the jaw. The internal is large and shallow, and owing to the obliquity of the axis its excavated surface approaches much nearer the inferior edge than does the surface on the external side. The trochlear surface of the quadrate meets this sigmoid surface at an acute angle, and so, when the mandible is depressed, rotation takes place in such a way that the anterior portion of the mandible moves downwards, backwards, and outwards, thus allowing the gape to be opened to its fullest extent without dislocation of the bones.

The dentary presents an external and internal surface, a superior and an inferior edge. The bone is bent into two curves; the first portion is at right angles to the long axis of the head, the second is parallel to the long axis, at the same time having a small curve inwards so as to make the external surface concave.

The external surface runs backwards and bifurcates, enclosing the anterior extremity of the splenial. The greater portion of this surface is covered by the gland. A large mental foramen is placed close to the bifurcation.

From the inferior portion of the anterior third of the interior surface, there arises, in a well marked excavated surface, the genio-glossus muscle, and above this the genio-trachealis. Below the genio-glossus, and running along the inferior border, the inter-mandibular muscle arises.

The anterior extremity gives attachment to the intermandibular ligament.

The superior border contains about a dozen teeth. The inferior border gives attachment to the muscles as stated above.

Os Præfrontale vel Anteorbitale.

Lachrymale vel Frontale anterius, D'Alton; *Frontal antérieur*, Cuvier; *Ethmoidale laterale vel præfrontale*, Gegenbaur, Harting, Wiedersheim; *Prefrontale*, Huxley; *Præfrontale*, Hoffmann; *Thränenbein*, Meckel; *Frontale anterius vel Orbitale anterius*, Joh. Müller, Owen; *Præfrontale vel Ante-orbitale*, Parker, Parker and Bettany; *Frontale anterius vel Ethmoideum*, Stannius; *Thränenbein*, Rathke.

The anterior orbital is an irregularly shaped bone resembling somewhat the letter Z, being composed of two horizontal and one vertical piece.

The superior horizontal bar presents a superior surface flattened internally, while externally there is a notch for articulation with the projection of bone from the frontal.

The notch is formed by an excavation which runs from above downwards and outwards, at the same time extending more posteriorly below than above. The internal portion of the inferior surface of the bone is flat, and gives attachment to the posterior portion of the nasal capsule, while the external portion rests on the pedicle of the bone.

The pedicle is prismatic in outline, its axis running from above downwards and outwards. The anterior surface is quadrilateral, smooth, convex, and sub-cutaneous. The posterior surface smooth with a large foramen at its lower edge, which leads to a canal that opens on the inferior surface. This transmits the lachrymal duct. This surface bounds the orbit anteriorly.

The internal side of the prism is mainly composed of membrane, so that a cavity is formed in the bone which is in relation with the nasal canal close to the posterior nares.

The inferior plate of bone is prismatic. The pedicle rests on the internal half of its superior sides, while the outer half of the plate helps to complete the antero-lateral portion of the orbit.

The inferior surface is triangular in outline, the base of the triangle being internal. The inner portion of this surface is very slightly convex from before back, while the surface as a whole is slightly concave from side to side.

This bone shows at first sight a great difference to the corresponding bone of *Morelia* or any other python; the chief difference is in connection with the maxilla. The bone in *Morelia* occupies a more horizontal position, so that what was the anterior face of the pedicle in *Acanthophis* becomes the superior here; but, at the same time, the superior face is curved down, so that it becomes more or less antero-external, and it is the inferior border of this antero-external moiety that corresponds to the articular surface of the inferior horizontal plate in *Acanthophis*, a process forming the antero-lateral border of the orbit corresponding to the one described above. The posterior face presents a difference, in as much as it sends down processes which are united to the palatine, maxillary, and transverse bones by ligament. Owing to the horizontal position the internal border of the superior plate comes into contact with the nasals. The bones differ from those of *Pseudechis* and *Daboia* in the shape of the inferior horizontal plate. In these forms the inferior plate is convex, and forms a kind of ball and socket joint with the concave surface of the maxilla below.

Os Maxillare.

Maxillare superius, D'Alton, Cuvier; *Maxillare*, Gegenbaur, Hoffmann, Huxley, Owen, Parker, Parker and Bettany, Wiedersheim; *Oberkiefer, supra-maxillare*, Harting, Meckel, Joh. Müller, Stannius.

The maxilla is a crescent-shaped bone, convex externally, concave internally, and longer from before backwards than from side to side.

The superior surface is semilunar in outline, much wider in front than behind. Antero-internally it is slightly concave from before back. The inferior surface forms the alveolar margin which

carries one fang firmly fixed to the bone, while two accessory ones lie embedded in the mucous membrane immediately behind. On the posterior third of this margin there are three small permanently erect teeth. The anterior surface is smooth and convex, with a small depression over the fixed fang. Over this surface the venom duct runs to reach the fang. The external surface is the continuation of the anterior; it has a small groove for the venom duct to lie in. The internal surface presents two regions, an antero- and a postero-lateral, and between them a strong process. The antero-lateral is the smaller of the two, and is formed by an excavation of the bone from above downwards and outwards; thus a concave surface is formed in which the palate bone fits. Behind this concavity the bone is produced downwards, inwards, and backwards, so that a prominent process is formed which lies on the palate, and is closely connected to that bone by ligament; the process also receives some of the fibres of the parieto-palatine muscle. The posterior two-thirds of this side is deeply excavated, forming the postero-lateral fossa. This is chiefly filled by the mucous membrane in which the accessory fangs lie.

The posterior extremity presents an articular surface consisting of a concave surface externally and a convex internally; it articulates with the transverse bone.

The bone differs from that of *Morelia,* in which the bone is long and prismatic-like, with all the teeth of nearly equal size. From *Daboia* it differs essentially in having the three solid teeth behind. It differs from *Diemenia* and *Pseudechis* only in the shape of the superior surface, which in these two forms is more concave so that the bone may move freely on the anterior orbital. Thus we see that this bone alone enables us to decide as to the classification of *Acanthophis.*

Os Transpalatinum.

Pterygoideum externum, D'Alton, Harting; *Transversum,* Cuvier, Joh. Müller; *Os transversum oder äusseres Flügelbein,* Gegenbaur; *Transversum,* Hoffmann, Huxley, Wiedersheim; *Hinteres Flügelstück,* Meckel; *Ektopterygoid,* Owen, Stannius; *Transpalatinum,* Parker, Parker and Bettany.

The transpalatine is an irregularly shaped bone, about half the length of the pterygoid. Viewed from above it is seen to be convex externally; viewed from the side the anterior half is so curved that the convexity is above. The anterior extremity is flattened from above downwards, and presents an articular head for the maxilla, the external portion being convex, the internal concave. The superior surface is convex, while a deep fossa occurs on the inferior. To the superior surface is attached a well marked band of fascia running from the postorbital bone above, which serves to bound the orbit, suspend the transpalatinum and limit its anterior movement, and lastly to form a floor for portion of the venom gland to rest on. At the junction of the anterior with the posterior half of the inferior surface, there springs a strong recurved process. To this, as well as to the posterior half of the inferior surface, the lower head of the internal pterygoid muscle is attached. The posterior extremity, as well as portion of the internal surface, articulates with the pterygoid bone.

The chief point in connection with this bone is the prominent recurved process of the inferior surface. In some lizards we have observed a somewhat similar process. It is also to be observed that the insertion of the pterygoid muscle into this bone is one of the reasons for considering that *Acanthophis* is far removed from the vipers.

Os Pterygoideum.

Pterygoideum externum, D'Alton, Harting; *Pterygoid*, Cuvier, Gegenbaur, Huxley, Hoffmann, Joh. Müller, Owen, Parker, Parker and Bettany, Stannius, Rathke, Wiedersheim; *Vorderes Flügelstück des Keilbeins*, Meckel.

The pterygoid is a scimitar-shaped bone, and thrice as long as the palatine. The anterior third is prism-shaped with its external side slightly convex, while the posterior two-thirds is flattened from above downwards, with a well marked concavity externally. The superior surface of the anterior portion of the bone gives insertion to a few fibres from the parieto-palatine muscle. The

inferior surface is the alveolar border supporting a number of small recurved teeth. The anterior extremity articulates with the palate by a ginglymus joint. The posterior two-thirds of the bone is twisted on its long axis, so that the interior surface comes to lie internally, and slopes from above, downwards and inwards. To this surface is attached the pterygo-sphenoid muscle, while the parieto-pterygoid is inserted on the external border. The transverse joins the bone at the junction of the anterior with the middle half of the external border. The inferior surface is deeply excavated, and gives attachment to the internal pterygoid muscle; while a number of small teeth spring from the inner border of the surface.

The posterior extremity of the bone comes to a point, from which a ligament springs which connects the bone with the inner side of the articular. This connection is not an intimate one, and we can find no such arrangement of the extremity of the pterygoid, such as Huxley has described in *Crotalus*. This point will be dealt with below.

Os Palatinum.

Os Palatinum, all authors.

The palatine is a prism-shaped bone slightly longer than the maxilla. In the posterior half of its upper border is attached the parieto-palatine muscle. To the middle of this border the maxilla is attached by ligament. The inferior border carries five solid teeth almost the same size as those on the posterior part of the maxilla. The external border fits into the groove on the antero-lateral surface of the maxilla. The posterior extremity articulates by a ginglymus joint with the pterygoid.

The bone differs but slightly in any of the forms examined.

Hyoid Bones.

The osseous portions of the hyoid bones are represented by two thin bars which run forward on either side of the posterior portion

of the tongue. They end at about an inch from the symphysis of the mandibles by converging towards the mid-line, and then coalescing below the tongue. They are hidden from view by the costo-mandibular muscles attached to their inferior surfaces, while the mylohyoid arises from them anteriorly, and the hyoglossi are attached along their internal borders. The genio-hyoglossi are inserted into their anterior portions, and the hyo-trachealis arises from the same region.

The length of the bars varies in the various species examined, being about $1\frac{1}{2}$ inch in *Acanthophis*, but about 3 inches in both *Pseudechis* and *Diemenia*, so that the hyoglossi in these species do not arise from the whole length of the bones, but only from the anterior half, while posteriorly there is a special interhyal muscle developed. These bars are taken by previous writers to represent the ceratohyals of other groups.

In *Daboia*, and, to a less degree, in *Acanthophis* and *Pseudechis*, there is an arrangement which appears to throw light upon the true homology of these parts. The osseous bars run forward and converge to the mid-line, where they fuse with a small plate of cartilage (?). From either side of this plate there run out two well-marked tendinous bands which intersect the mylohyoid and the costo-mandibular muscles. Each band runs a little forward and outwards, and then turning sharply runs backwards and outwards, and is lost at the posterior extremity of the mandible. Thus we have a hyoid apparatus very similar to that described and figured by Parker for *Lacerta agilis*, and also like what we find in *Hinulia*.

Taking this view of the hyoid apparatus, we consider that the anterior intersections represent the hypohyal, and ceratohyal; the stylohyal we have seen to be attached to the quadrate. The plate at the junction of the two osseous bars will therefore be the basihyal.

The second intersection will be the first branchial bar, while the two ossified rods usually considered to be ceratohyals will be the hypobranchial bars.

The Vertebral Column.

The vertebral column of ophidians is generally divided into two regions, a costal and a caudal. Rochebrune has, however, gone very fully into the subject of the vertebræ of snakes, and he distinguishes five regions, cervical, thoracic, pelvic, sacral, and coccygeal or caudal.

The cervical vertebræ are two in number, and are devoid of ribs; they represent the atlas and axis. The thoracic and pelvic vertebræ have ribs, with ossified processes anchylosed to their lateral aspects. The caudal are distinguished by possessing a bifid hypapophysis. The only difficulty that arises is in distinguishing the thoracic vertebræ from the pelvic. The thoracic possess hypapophyses without exception; the pelvic in certain forms only. When, therefore, both regions have hypapophyses Rochebrune distinguishes between them thus:—

"*Thoracic.*—Brièveté relative du corps, surélévation et inclinaison des lames, abaissement brusque et raccourcissement des processus, direction oblique du tenon, position élevée des tubercules costaux; développement exagéré des apophyses épineuses supérieures et inférieures; largeur de la partie supérieure du trou rachidien."

"*Pelvic.*—Epaisseur et longueur relative du corps; aplatissement et écartement des lames; amincissement et relèvement de l'extrémité des processus; direction droite du tenon; position en dessous des tubercules costaux; développement des apophyses transverses; brièveté et largeur relatives de l'apophyse épineuse; brièveté et inclinaison de l'hypapophyse; aplatissement de la partie supérieure du trou rachidien."

Taking a thoracic vertebra we shall compare the vertebræ of the other regions with it.

Centrum: The centra are procoelous. The articular faces are ellipsoidal, the long axis being transverse. The edge of the "socket" is slightly concave above and below, the appearance

being caused by the lateral portions projecting more forward. This has reference to the fact that the vertebræ generally move in the transverse and not in the vertical plane. The "ball" of the posterior articular surface is almost a hemisphere. On looking at the surface in profile the curve of the upper third of the ball is seen to be the circumference of a smaller circle than the lower two-thirds, while the lateral portions of the rim are produced forward so as to correspond with the lateral edges of the socket.

The centrum as a whole is somewhat pyramidal, the base being posterior. The base slopes from above downwards and backwards, and it is upon this surface that the "ball" of the posterior articular surface rests. It follows from this that the axis of the posterior face, instead of corresponding with the axis of the centrum, makes an angle of about thirty degrees with the long axis of the body. The advantage of this will be seen hereafter.

The anterior portion of the centrum corresponding to the apex of the pyramid bears the concave anterior articular face. The dorso-ventral axis of this face is inclined from before, downwards, and backwards. Owing to this the lower three-fifths of the socket rests on the front of the pyramid, while the upper two-fifths is free, and inclines forward. The reason for this becomes evident when we take a longitudinal vertical section of two vertebræ; we then see that the superior part of the cup rests on the upper and most curved portion of the ball, while the lower three-fifths rests on the less curved portion of the ball. We thus have a ball and socket joint, the dorso-ventral axis of which is downwards and backwards, and thus is formed a joint capable of withstanding greater force from above downwards than if the axis of the ball and socket was parallel to the long axis of the body.

From the anterior portion of the external surface the diapophysis and parapophysis spring; while from the inferior surface a strong recurved hypapophysis projects. On each side of the base of the hypapophysis are seen two excavations from which the levatores costarum interni spring. The superior surface forms the floor of the neural canal.

Pedicles: The pedicles arise from the lateral portion of the superior surface of the centrum. They are very short anteriorly, but longer behind, and run upwards and slightly outwards. The external surface is grooved for the subvertebral rectus muscle, while anteriorly the buttress of bone supporting the prezygapophysis springs from its side. The anterior and posterior edges are indented forming portions of intervertebral notches for the exit of the spinal nerves. Where the posterior portion of the pedicle joins the lamina the postzygapophysis is given off.

Laminæ: The laminæ run upwards and inwards from the pedicles to the mid-line; at the same time they are produced forwards and backwards to form the zygosphene and zygantrum respectively. The external surface of the lamina is excavated for the rotatores dorsi muscles. The anterior edge is taken up by the zygosphene; the posterior is well marked and runs outwards into the posterior edge of the first zygapophysis, while it is continued internally into the neural spine.

Neural spine: The neural spine springs from the junction of the laminæ in the mid-line. It is quadrilateral in outline. The edge is sharp, and the tendons of the spinalis dorsi are inserted on it. The anterior edge is likewise sharp, and gives attachment to the interspinales. The posterior edge is marked by an excavation in which the interspinales lie. The lateral sides of the spine are broad and smooth, and from here the spinalis dorsi and multifidus spinæ arise, the former above, the latter below.

Zygosphene: The zygosphene projects from the anterior borders of the laminæ as a well marked process. The superior surface is convex, and gives attachment to a strong ligament which helps to bind the vertebræ together. The lateral surfaces are bevelled from above, downwards and backwards, forming facets for articulation with the preceding zygantrum.

Zyantrum: The zyantrum is formed by the expansion of the laminæ posteriorly. It presents two facets, which will be understood by supposing a pyramidal piece to be excavated from the

internal face of the posterior portions of the diverging laminæ. The excavation is made from above downwards and outwards, but the floor runs downwards, inwards and backwards. Into this niche on either side a facet of the zygosphene fits, "like the joints called tenon-and-mortice in carpentry" (Owen).

Prezygapophysis: The prezygapophysis is supported on a pedicle of bones that runs upwards from the diapophysis. The articular face looks upwards, is oval, with a process from its anterior border. It runs downwards, inwards, and backwards. It articulates with the posterior zygapophysis of the preceding vertebra. The pedicle that supports the zygapophysis sends up a well-marked process external to the articular facet. This we consider to be a metapophysis. It gives attachment to the levatores costarum, longissimus, and intertransversarii muscles.

Postzygapophysis: The postzygapophysis is not so strongly built as the anterior, the reason being that the anterior is the supporting zygapophysis.

The articular facet is situated on the inferior surface, and consequently looks downwards, while at the same time it runs inwards, forwards, and slightly upwards, a small projection proceeding backwards from its posterior edge.

The superior surface of the zygapophysis is flattened, and is continuous with the external surface of the lamina. To this is attached the semispinalis.

Transverse Process: The transverse process is represented by a small projection of bone from the external side of the anterior portion of the centrum. On this projection an articular face is developed which is made up of two tubercles. The superior tubercle projects outwards, is rounded, convex, and more posterior than the inferior, which is oval, slightly convex, and larger than the superior. Between the two tubercles there is a depression, concave from above downwards. The axis of the whole articular face is downwards and forwards. Leading from the inferior

tubercle is a small pedicle of bone; this runs forward and downwards, and is regarded by Owen as representing a parapophysis.

Hypapophysis: The hypapophysis springs from the whole of the inferior edge of the centrum. It runs downwards and backwards. Its anterior edge is longer than its posterior, and slightly concave from above downwards. The external sides are rounded, and give attachment to the depressores costarum and subvertebral rectus.

Atlas: The atlas presents as in all vertebrates the most considerable modifications. The anterior face has three articular facets, while occupying the region of the centrum is the elliptical prominence of the anterior extremity of the odontoid process. Anteriorly and inferiorly this latter slopes rapidly downwards and backwards, while superiorly it extends upwards and backwards for a short distance only. On either side it meets the lateral facets of the atlas at an acute angle. These facets, which represent the articular surfaces of the lateral masses, spread out from the odontoid process like wings; they are triangular (the apex being superior) and concave. Each plate is placed so that its surface slopes downwards, backwards, and inwards, to meet the odontoid process, and thus, as mentioned above, an acute angle is formed on either side. The facets articulate with the exoccipital moieties of the trefoil condyle of the skull. The third face is the superior surface of the autogenous hypapophyseal portion of the bone. It is pentagonal in shape, the apex being in front. The surface is concave and lies anterior though inferior to the odontoid process, which it meets behind, making with it an angle of 60°. The anterior portion of this face presents a distinct ridge, which enables the occipital condyle to hook on most effectually. The neural arch is formed by two curved laminæ of bone running up to meet in the mid-line, the neural canal being wider, though less high, than in other regions. The neural spine is absent, a slight ridge taking its place. There is no prezygapophysis or zygosphene; the anterior superior edge being, however, in close relation to the posterior superior edge of the exoccipitals. A small prezygapophysis is

present, but no facets for a zygantrum, the posterior border projecting slightly over the axis, which has no zygosphene. Two small tubercles project from a weakly developed transverse process. The hypapophyseal region consists of a wedge-shaped piece of bone, the anterior portion of the superior surface of which was described above. It articulates with the inferior surface of the basioccipital portion of the condyle of the skull; it is also in contact with the odontoid process, and with the hypapophysis of the axis. A suture shows its autogenous separation from the atlas upon which it is freely movable.

The posterior articular surface of the bone presents two concave lateral facets, and a concave inferior facet. These all articulate with surfaces on the axis.

The various elements fit on to the occipital condyle in the following manner. The superior portion of the tubercle carries ligaments, while the anterior and inferior part fits into the V cleft formed by the exoccipitals on either side, and the basioccipital below. The lateral concave wings fit on the exoccipital; the small convex portion mentioned above fits in between the latter bone and the basioccipital. On the surface of the concave pentagonal plate of the hypapophysis, the convex surface of the basioccipital rests; and since the inferior edge of this bone is produced into a hook-like process, this fits into the ridge of this pentagonal plate.

Thus it can be seen that lateral movement of the head can take place to a degree; while upward movement is rendered almost impossible by the close apposition of the bones. On the other hand downward movement can take place to a considerable degree.

Axis: The odontoid process is represented by a sub-conical projection proceeding forward from the centrum. Three articular facets surround its base, the upper ones articulating with the lateral surfaces of the atlas, the inferior with the hypapophysis. The pedicles are short and straight, while the laminæ are quadrilateral, their antero-posterior and lateral measurements being equal. The neural spine is short and conical, and the neural canal is more

rounded than in the case of the atlas. There is a weakly developed anterior zygapophysis and a well developed posterior one. A short recurved spike of bone, springing from the transverse process, is in serial homology with the ribs. The anterior surfaces of the laminæ are not formed into a zygosphene, but there is a zygantrum developed posteriorly. The hypapophysis presents a reduplicated arrangement, for closely united to the hypapophysis of the atlas is seen a small process of bone separated by a suture from the odontoïd above. This is followed immediately by a well marked recurved spine, the true hypapophysis. The anterior of the two processes appears in all the snakes examined, and is also well developed in *Grammatophora*; while in the atlas of man a well marked nodule of bone may be sometimes observed in this situation. The third vertebra was remarkable in having no ribs attached to it; a small process of bone, anchylosed to the transverse process, being the only representative of a rib.

On considering the spinal column as a whole, we find that it is composed of two pyramids placed with their bases opposed to one another. In this it agrees with the observations of M. Rochebrune, who says, after examining a great number of skeletons of snakes, "On observe que l'axe osseux est formé de deux pyramides étroites sensiblement pentagonales, opposées par leur base la plus large, plus au moins longues en raison des os qu'elles renferment, et dont la première depasse rarement les trois huitièmes de la longueur totale du corps." The vertebræ number about 175; the exact number is difficult to ascertain, since the last fifteen are but thin leaves of bone. Of this number 124 vertebræ bear ribs.

The only points to be noted in connection with the first ten vertebræ are that they are relatively small, and that the neural spine, instead of springing from the whole line of junction of the laminæ, arises from the posterior portion only, and running upwards is constricted so that it appears somewhat hour-glass shaped when viewed from the side.

The hypapophysis is also longer and less oblique, and at the same time weaker than it is more posteriorly. Gradually, as we

continue back, we find the neural spine becoming broader antero-posteriorly, while the hypapophysis becomes shorter, and slopes downwards and backwards. The vertebræ as a whole become more stoutly made until we reach the fiftieth, which constitutes the base of the anterior pyramid. From this onwards we have the vertebræ decreasing in size, the neural spines becoming shorter, and springing from the whole length of the line of junction of the laminæ, while the hypapophyses also become shorter and more pointed. At the 126th vertebra we have the ribs ceasing, and in their place we now get two processes the exact nature of which has caused much discussion.

If we examine the vertebræ from this point to the 132nd we shall find that these processes spring from the transverse processes, the superior one arising from the upper tubercle, the inferior from the lower tubercle. A few vertebræ further back we have the superior process disappearing, and represented by a small projection only, from the surface of the inferior one; the appearance presented being similar to the letter ⋈. Still further back the superior process disappears entirely. At the vertebra where the ribs cease we have frequently a well-marked rod of bone, anchylosed to the superior portion of the rib, and freely movable by its inner extremity on the superior tubercle of the transverse process. This occupies such a position as the superior of the two processes mentioned above. It is to be noted that when this occurs we do not find the tubercle of the rib present.

Many conjectures have been hazarded as to the real nature of these processes. Rochebrune says, "Contrairement à l'opinion de Meckel ces apophyses ne sont pas dues à une bifurcation de la côte, la superieure est constituée par la pleurapophyse modifiée et soudée au centrum; l'inferieure est due au développement exagéré de la parapophyse, interprétation vers laquelle penche R. Owen." Owen says, "The diapophyses become much longer in the caudal vertebræ and support in the anterior ones short ribs, which usually become anchylosed to their extremities." Hoffmann says, "Ganz eigenthümlich ist die Erscheinung, dass wort wo die

præsacralen Wirbel in die postsacralen übergehen, die Rippen und die Processus costo-transversarii eine Gabelbildung zum Schutz der Lymphherzen bilden. Salle, welcher sich mit ihrem Bau ausführlicher beschäftigt hat, nennt dieselben, "Lymphapophysen," und je nachdem die Gabelbildung an den Rippen oder an den Processus costo-transversarii (Querfortsätz, Salle) vorkommt "costale" oder transversale costo-transversale." And again, "Was die Entwickelungsgeschichte der Lymphapophysen angeht, so theilt Salle mit, dass beide Schenkel gleichzeitig von einer gemeinsamen Basis auswachsen, Knorpelig angelegt werden und später ossificiren." In endeavouring to account for the homology of the parts we are met with this difficulty. If we take Salle's observation as correct, both processes spring from the one point, then the process that is in connection with ribs must either represent both processes coalesced into one and differentiated off from the vertebræ, or else it contains only the representative of one of the processes; or thirdly, that it has no connection with either of the posterior elements. If we were to suppose that the rib was an outgrowth from the side of the vertebra, our difficulty would then vanish, for we would then have two processes springing from the vertebra in each case, but being differentiated off in the one instance, and remaining attached in the other. To this it must be said that all late investigations tend to show that the ribs are not an outgrowth from the vertebræ, but are formed quite independently. The question arises, can even development prove the homology of the process attached to the ribs? We doubt if it could; for were it to be shown that the process arose independently of the vertebra, then the objection remains that the posterior ones are outgrowths from the vertebræ. And if, on the other hand, the process arises as an outgrowth like the posterior one, then which of the two does it represent?

The fact seems to be clear, that, as regards the actual position of the two processes, the superior corresponds to the detached process connected with the rib, while the inferior corresponds to the rib itself. If this be so then we think that the following statement by Flower may throw some light on the subject:—

"There can be no doubt, but that an autogenous process of one vertebra of an animal may be serially represented by an exogenous process in another vertebra of the same animal; and likewise that the corresponding processes of the same vertebra may be developed exogenously in one animal and autogenously in another."

In dealing with the prezygapophysis above, we suggested that the process connected with it might represent a metapophysis, and we now suggest that the superior of the two processes may be an anapophysis, while the inferior may represent the lumbar transverse process of higher animals.

From the 133rd vertebra to the end we have considerable alterations. The elements of the vertebræ begin to diminish in size, and at the same time the hypapophysis becomes bifid. Rapidly the processes become less conspicuous, so that when we reach the last fifteen vertebræ we find a neural arch formed by the diminutive laminæ supporting a thin perpendicular spine, while inferiorly the hypapophysis is represented by two small spicules of bone only.

In comparing the vertebral column of *Acanthophis* with that of *Pseudechis* and *Diemenia*, we see no very marked difference. The processes from the prezygapophysis are more conspicuous, and the neural spines are not so high in these two forms. The greatest dissimilarity exists in regard to the tail vertebræ which are more stoutly made, and exhibit the same processes as the anterior, only less well developed. As compared with *Morelia* the zygantrum of the latter is much more excavated, the articular surfaces on either side being separated anteriorly only by a slight ridge of bone in the mid-line. In the second place there are no processes (metapophysis?) springing from the prezygapophysis, a slight ridge below the articular head being the only representative; neither are there any inferior processes from the lower portion of the transverse processes.

Perhaps the most striking difference arises in the connection with the hypapophysis. In all venomous snakes that we have examined there is a well-developed hypapophysis on all the vertebræ that bear ribs, but in non-venomous forms the

hypapophyses cease to be developed at a variable distance from the anterior extremity. In the following table we show how variable the processes are :—

	Vertebræ.	Ribs.	Hypapophyses.
Morelia	363	273	78
Python sp.	340	259	69
Zamensis carbonarius	310	195	38
Boa constrictor	305	?	60
Python tigris	291	251	74
Deurodon scaber	256	?	32
Crotalus horridus	194	168	194
Acanthophis	175	124	175

Soon after the ribs cease the hypapophyses again appear, but in a bifid form. The nature of the hypapophysis has called forth much discussion, and Rochebrune has made the following remarks concerning the subject :—

"Les anatomistes attribuent à l'hypapophyse un rôle importan, dans le mécanisme des mouvements, et tout en la considérant comme destinée à servir d'attache aux muscles fléchisseurs du tronct ils n'hesitent pas à voir en elle un obstacle à la flexion du corps en dedans. . . . Pour faire voir que l'influence de l'hypapophyse, comme obstacle à la flexion en avant, est de nul effet, il suffit de renvoyer à ce qui à été dit au sujet des espèces dendrophyles, à longues hypapophyses malgré leur mobilité excessive, et aux descriptions des hypapophyses longues, droites et minces des genres Python, Boa, etc." Rochebrune then goes on to say that he considers them of only secondary importance as regards muscular attachment. He supposes that the hypapophyses play an important part in the ingestion of the prey. "La longuer de la ligne hypapophysaire dépasse rarement celle de l'œsophage et de l'estomac ; l'une et l'autre sont en rapports directs, de telle sorte qu' à l'inspection d'une colonne rachidienne, il est possible de determiner l'étendue des deux organes." He sums up by saying, "Les hypapophyses nous semblent donc être destinées, tout par-

ticulièrement, à maintenir le bol alimentaire pendant les contractions que nécessite l'acte de la déglutition, et à faciliter son cheminement à travers le canal alimentaire."

After examining the subject attentively we certainly reject the suggestion of Rochebrune with regard to the processes hindering the regurgitation of the food. We do not hesitate to say, that had such been the case "selection" would in time have brought about a much more efficient mechanism than at present exists in the poorly developed hypapophyses of non-venomous snakes. In *Deirodon* alone have we not an example of how efficiently "selection" will act when called upon? We prefer to adhere to the view that the hypapophyses are developed to give attachment to muscles. The question therefore arises, why should the hypapophyses disappear in some species and not in others? The only explanation we can give is that the hypapophyses are developed not only in snakes, but also in the higher animals in the cervical and caudal regions, while less commonly in the lumbar region; and that along with the appearance of the hypapophyses we have well marked hypaxial muscles developed. In the snake, while the hypaxial muscles are developed throughout the whole column, yet we have anteriorly the conspicuous bundles of the rectus capitis group calling for much more extensive bony attachment than could be afforded by the vertebræ without hypapophyses. In the venomous snakes we find that the hypaxial muscular bundles do not flatten out as in the non-venomous species, and this may be the reason why we should always find greater processes. And going a step further we say that the muscles remain more rounded in order to act most efficiently, by aiding the rapid movements which characterise venomous snakes.

THE RIBS.

The rib consists of a shaft and two extremities. The inner or vertebral extremity presents for examination an articular surface and a well marked process. The articular face is reniform, the concavity being anterior. Its superior portion is concave, and articulates with the upper facet of the transverse process of the

vertebra, while its inferior portion is slightly convex, and glides over the surface between the two facets of the transverse process. The process springs from the upper portion of the extremity, and is continuous with the posterior surface of the shaft. It runs upwards and backwards, and gives attachment to the innermost bundles of the external intercostal muscles; while the superior vertebro-costal ligament, running forwards and outwards round the superior surface of this process, thus prevents rotation forward of the upper and inner portion of the rib.

The Shaft: The shaft is prismatic in shape and presents an anterior, posterior, and inferior surface, together with three borders.

Anterior surface: To the upper portion of the inner third of the anterior surface are attached the levatores costarum externi; while to the lower portion of this inner third and to the whole of the outer two-thirds are attached the external intercostals.

Posterior surface: The posterior surface, (which if continued internally would end in the process described above) gives attachment to the external intercostals.

Inferior surface: The inferior surface is more rounded than the preceding ones, but it is not well defined from the posterior surface, except internally. The external intercostals arise from here as well as from the posterior surface.

There are three borders, a superior, anterior, and posterior.

Superior border: The accessory portion of the sacro-lumbalis column arises at the junction of the inner two-fifths with the outer three-fifths; while immediately external to this we have the sacro-lumbalis inserted, and the pretrahentes costarum superiores, and the external oblique arising. The pretrahentes superiores cover the middle third, and are inserted at the junction of this with the outer third over which the pretrahentes inferiores run.

Anterior border: The anterior border when followed inwards is seen to end in a tuberosity which gives attachment to the levatores costarum interni, and the inferior vertebro-costal ligament. The outer third of this border gives origin to the retrahentes costarum.

Posterior border: The posterior border gives insertion to the depressores costarum. At its middle point, and just external to this, we have the origin of the transverse muscle, and still more external the insertion of the retrahentes costarum. The external extremity gives attachment to the costal cartilages, which give origin to the internal oblique, and the antero-posteriorly directed fibres of the external intercostal muscles.

Myology.

Muscles of the Head.

On the integument being reflected from the cephalic region the muscles of the head are displayed covered only by a delicate fascia, which runs forward to be lost on the frontal bones. In the mid-line the greater portion of the median triangle of the parietal bone is to be seen uncovered by muscle. On either side anteriorly lie the masseters resting on the venom gland beneath, and covering the anterior, and portion of the posterior, temporal muscles. Posteriorly the quadrilateral-shaped digastric runs outwards and backwards to the extremity of the mandible, where it is covered by the fibres of the retractor oris as they run from the neural spines downwards and forwards to end at the symphysis of the lips. Inserted on to the supraoccipital is seen the spinalis dorsi, while on the exoccipital of either side is the complexus. Posterior to the retractor oris the depressor mandibulæ springs, and runs forward and downwards to merge into the mylohyoid between the mandibles below.

Masseter.

M. parietali-quadrato-mandibularis (seine vordere Portion), Hoffmann; *Schliesser des Mauls oder Beissmuskeln,* Hübner; *Der grosse Beiss- oder Shläfenmuskeln (seine vordere Portion),* D'Alton; *M. temporalis,* von Teutleben; *Masseter,* Owen; *Temporalis anterior,* Duvernoy, R. Jones.

The masseter arises from the lower two-thirds of the external surface of the postorbital bone, and from the upper portion of the lateral triangle on the superior surface of the parietal. The

muscle is in two parts. The superior or superficial portion arises mainly from the parietal, and its fibres run downwards and backwards to become inserted by a tendon on the posterior part of the superior surface of the capsule of the venom gland; at the same time some of the fibres are inserted more anteriorly. The deeper portion of the muscle arises in great part from the postorbital, and runs downwards and backwards to form the internal fibres of a band of muscle which arises from the internal aspect of the capsule of the gland. The muscle turns round the commissure of the lips, and runs forward to be inserted on to the anterior two-fifths of the external surface of the articular moiety of the mandible, immediately behind the dentary.

The muscle is thus seen to be composed of three portions, and in this respect it agrees with the description given by Duvernoy (5) of *Naja* and *Bungarus*. In *Pseudechis* and *Diemenia* the arrangement is very similar, there being, however, more muscular fibres inserted on the gland anteriorly. In *Morelia* the upper portion of the muscle is represented, its fibres run downwards and backwards, and end in a tendinous expansion which is inserted on the mandible for a short distance. The muscle is, in this latter snake, and the same seems to hold good for all the *Colubridæ*, in relation with the large lachrymal gland, and gives fibres to it to form a special compressor. D'Alton describes this muscle as arising by two heads in *Python bivittatus*.

In *Daboia* the masseter is but slightly attached to the parietal bone; it arises chiefly from the superior surface of the capsule of the gland, and runs downwards and backwards so as to be more posterior to the gland than in the *Elapidæ*. This seems to be the typical manner of origin of the masseter in vipers.

Posteriorly the masseter is related to the posterior temporal muscle, while on reflecting it the anterior and deep temporal come into view together with branches of the fifth nerve, one of which supplies the muscle. The muscle acts as an elevator of the mandible and compressor of the venom gland, and of the lachrymal gland in colubrine snakes.

M. TEMPORALIS ANTERIOR.

Zweite mittlere Portion of No. 1, D'Alton, Hoffmann; *M. temporalis*, Owen; *Middle temporal*, Duvernoy, R. Jones.

The anterior temporal arises from the outer portion of the lateral triangle of the parietal, and from a small part of the superior surface of the prootic. The anterior fibres running backwards and the posterior forwards, meet, and together they descend over the rounded anterior portion of the squamosal, and running back are inserted into the superior edge of the middle third of the mandible above and behind the insertion of the masseter.

The muscle is well developed and of considerable size in *Acanthophis*, *Diemenia*, and *Pseudechis*; while in *Morelia* it is a very powerful muscle, occupying a great portion of the postorbital fossa. In *Daboia* it is however of small size, and is represented by a band of muscle which arises from the side of the parietal, and running outwards and downwards comes to be anterior and external to the insertion of the masseter.

The anterior temporal is covered by the masseter and part of the venom gland, while it is closely related to the branches of the third division of the fifth nerve, which emerge far under its anterior border. Behind it is closely related to the posterior temporal and external pterygoid, while internally it covers in the parieto-pterygoid and parieto-palatine muscles. It is supplied by the fifth nerve.

Its action is to raise the mandible; in *Python* it is the chief muscle in this action. It depresses the cranium when the mandible is fixed.

M. TEMPORALIS POSTERIOR.

Dritte Portion of No. 1, D'Alton, Hoffmann; *Posterior temporal*, Owen, Duvernoy, R. Jones.

The posterior temporal arises from the upper three-fourths of the external surface and edge of the quadrate. Its fibres run downwards and forwards to be inserted into the ridge, and the excavated area on the middle third of the external surface of the surangular plate of the mandible, having the insertions of the masseter and anterior temporal anteriorly, and the mylohyoid inferiorly.

The muscle is related to the digastic posteriorly, while some fibres of the retractor oris spread over it externally. Internally the muscle hides from view the external pterygoid.

The muscle differs but slightly in all the forms examined. It is supplied by the fifth nerve. Its action is to raise the mandible, or when the latter is fixed to depress the cranium.

M. PARIETO-MANDIBULARIS (muscle of the epipterygoid bone).

Die vierte Portion of No. 1, Hoffmann, D'Alton.

On reflecting the masseter and pushing aside the venom gland, a thin rounded muscle is observed lying in front of the anterior temporal muscle. It arises from the prominent projection at the junction of the middle-lateral with the posterior-lateral edge of the parietal bone. It runs downwards and backwards to be inserted on a small area of the upper portion of the middle third of the internal surface of the mandible. The muscle was described by D'Alton, who took it to be a portion of the temporal muscle (tiefste Portion). Hoffmann has likewise described it as portion of the temporal. An important relation is established by a large branch of the third part of the fifth nerve, which emerging from under cover of the anterior temporal muscle winds round this muscle, and separates it from the temporal group.

In *Hydrosaurus* a similar muscle is present, springing from the parietal, and the superior portion of the epipterygoid (columella) and being inserted on to the mandible. The nerve has the same relation to it as in the snakes. The muscle appears in all the snakes examined, and Sanders (No. 25), has described a muscle similar to this in *Platydactylus* and *Liolepis*. He however says that the muscle is inserted into the pterygoid bone; this we think is a mistaken observation. He suggests that the muscle corresponds to the tensor tympani, but we are at a loss to see on what ground he could found his homology. It may belong to the temporal group, but the relation of the nerve to it forms an obstacle to its being considered so. On the other hand it is supplied by the third division of the fifth nerve.

It is interesting to find this muscle in the ophidians from its relation to the columella in the lacertilians, since we see the bone disappearing, but the muscle remaining to aid as an elevator of the mandible.

M. PTERYGOIDEUS EXTERNUS.

Part of posterior temporal, Hoffmann, D'Alton, Owen, Jones, Duvernoy.

On the posterior temporal muscle being removed, the fibres of the external pterygoid are displayed, arising from the whole of the anterior edge and part of the internal surface of the quadrate; the muscle runs downwards to be inserted into the whole of the mandibular fossa. The muscle is separated from the posterior temporal by fascia, and by the inferior dental nerve which winds round its anterior edge to gain the external surface, where it runs to enter the foramen on the mandibular fossa. The muscles presented no differences in any of the snakes examined. The muscle is usually regarded as part of the posterior temporal, and no previous observer has described it as being at all separated from the posterior temporal. Whatever be the proper homologue of this muscle it must certainly be described as being quite distinct from the posterior temporal. We think it approaches more closely to the external pterygoid than the muscle usually described under that name. It is supplied by the third division of the fifth nerve.

M. PTERYGOIDEUS INTERNUS.

M. tranverso-maxillo-pterygomandibularis, Hoffmann; *Aeussere Flügelmuskel,* D'Alton; *Pterygoideus externus,* von Teutleben; *Pterygoideus externus et internus,* Duvernoy and R. Jones; *M. ektopterygoideus et M. entopterygoideus,* Owen.

The internal pterygoid arises by two heads. The external or inferior head springs from the lower portion of the external surface of the posterior two-thirds of the mandible. The inner head arises from the lower part of the posterior third of the inner face of the mandible, and from the capsule of the quadrato-mandibular joint, and from the inferior extremity of the quadrate bone. The

two heads coalesce into a rounded belly of muscle which runs forward and downwards, the lowermost fibres being inserted on to a special process in the middle of the inferior surface of the transverse bone, and also into the posterior half of that bone. The upper fibres, (or those that mainly spring from the internal surface of the mandible), are inserted into the inferior surface of the posterior half of the pterygoid bone. The muscle at its origin has the digastric above it externally, while the spheno-pterygoid lies on the internal face. Inferiorly the muscle is completely covered by the mylohyoid.

The muscle is usually described as two, *i.e.*, the external and internal pterygoids. We have carefully dissected several forms to ascertain if there are any grounds for this separation, and we find that the separation into two muscles is quite unnecessary. The same holds good for *Hydrosaurus*. We may also add that the same nerve supplies both parts of the muscle.

In *Daboia* and in all vipers the muscle is prolonged forward so as to be inserted into the maxilla, and at the same time sending a tendon to act on the mucous membrane that covers the fangs. This arrangement of the pterygoid muscle forms a valuable means of distinguishing the vipers from the venomous colubrine snakes. The insertion of the muscle in *Acanthophis* into a special process on the transverse bones is interesting, as a similar process for its insertion is seen in *Hydrosaurus*.

M. DIGASTRICUS (Posterior belly).

M. occipito-quadrato-mandibularis, Hoffmann; *Niederzieher des Unterkiefers*, D'Alton; *M. temporalis*, von Teutleben; *M tympano-manibularis*, Owen; *M. digastricus*, R. Jones, Duvernoy.

The digastric arises by two distinct portions. The smaller one springs from the ridge between the supraoccipital and the epiotic bones, and from the posterior third of the superior surface of the squamosal; the larger portion arises from the posterior surface of the quadrate, and from the capsule of the joint between the quadrate and the squamosal. The bellies coalesce above and run

downwards and backwards to be inserted into the whole of the triangular area on the upper surface of the articular, immediately behind the quadrato-mandibular articulation. The two bellies are more distinct in *Morelia.* They also appear to be well marked in *Crotalus durissus* as figured by Duvernoy.

The muscle is supplied by the seventh nerve.

Its lower portion is covered externally by the fibres of the retractor oris. It is the chief muscle in opening the mouth of the snake, since it acts on the posterior extremity of the mandible, raising it and so depressing the anterior portion.

M. PTERYGO-SPHENOIDALIS (Levator palati).

M. pterygo-sphenoidalis posterior, Hoffmann; *Innere hintere Flügelmuskel,* D'Alton; *Spheno-pterygoid,* Duvernoy, R. Jones; *Prespheno-pterygoideus,* Owen.

The pterygo-sphenoidalis arises from the lateral surface of the parasphenoid bone as a narrow strip of muscle; this runs backwards and is continuous with a broader belly which arises from a special excavation on the basisphenoid, close to the median line. The muscle runs downwards, backwards, and outwards to be inserted on the superior surface of the posterior half of the pterygoid bone. At its origin the muscle has the spheno-vomerine muscle lying externally, while the parieto-pterygoid lies externally at its insertion. The muscle is hidden from view by the aponeurosis that covers the roof of the mouth.

According to Owen it represents the levator tympani of fishes. We, however, regard it as the levator palati for the reasons given below.

The muscle is one of the most powerful of the head group, and is the chief protractor of the pterygoid bone, and hence the chief erector of the fang.

M. PTERYGO-PARIETALIS. (Part of tensor palati).

M. pterygo-parietalis, Hoffmann; *Der Hebemuskel des inneren Flügelbeins,* D'Alton; *M. orbitalis,* Hübner; *M. post-orbito-palatine,* R. Jones; not mentioned by Owen.

The pterygo-parietalis arises from the anterior portion of the postero-lateral edge of the parietal, and from the lateral plate of the parietal immediately below. It runs downwards, backwards and outwards, to be inserted on the middle third of the external edge of the pterygoid bone, and slightly into the posterior extremity of the transverse bone. As the muscle passes backwards it is closely connected with the external face of the spheno-pterygoid muscle; while the anterior temporal and parieto-mandibular muscle, together with the branches of the fifth nerve, cover it externally.

The muscle is very large in *Daboia* and arises more anteriorly than in *Acanthophis*.

Cuvier regarded the muscle as a dismemberment of one of the temporal group. From the relations of the nerve trunks to it, we consider that it has no connection whatever with the temporal muscles, and, as shown below, we believe it to be a specialised tensor palati. The nerve of supply emerges behind the fifth, from a foramen in the lower part of the alisphenoid, and occupies such a position as the nerve for the otic ganglion does in the higher animals.

The muscle acts as a protractor of the pterygoid bone, and therefore as an erector of the fangs.

M. PARIETO-PALATINUS (part of the tensor palati).

M. pterygo-sphenoidalis anterior, Hoffmann; *Innerevordere Flügelmuskel*, D'Alton; *M. palatinus*, Hübner; *Prespheno-palatine*, Owen; *Spheno-palatine*, Duvernoy, R. Jones.

The parieto-palatine muscle arises from the posterior concave surface on the lateral plate of the parietal bone, and runs forwards, downwards, and outwards, to be inserted on a small portion of the pterygoid, and on to the posterior two-thirds of the palatine bone. Some fibres may be traced to the mucous membrane surrounding the fangs, here performing the office of retractors of the membrane. The muscle lies at its origin between the parieto-pterygoid and the pterygo-sphenoid muscles, and as it runs forward it comes into relation with the fascia covering the lachrymal gland.

It is this muscle which acts slightly on the gland in venomous serpents, while it is the masseter in the non-venomous. This muscle is supplied by the same nerve as the parieto-pterygoid, and we regard it as part of that muscle. In *Diemenia* there is essentially but one muscle. We have changed the title of spheno- to parieto-palatine, since the muscle arises wholly from the lateral plate of the parietal in all the venomous forms that we have examined; while in *Morelia* it arises lower down, but even here but few fibres are attached to the basisphenoid. In *Python*, according to D'Alton, the muscle arises in great part from the basisphenoid. The muscle in *Daboia* arises more anteriorly than in *Acanthophis*, so that it comes to lie more in the orbital fossa.

The muscle retracts the palatine and pterygoid bones, and also, as mentioned above, acts on the mucous membrane of the fangs in the *Elapidæ*; this action being performed by the pterygoid in the vipers.

M. VOMERO-SPHENOIDEUS.

M. vomero-sphenoideus, Hoffmann; *Zuruckzieher des Vomer*, D'Alton; *M. sphéno-vomèrien*, Dugès and Duvernoy; *Prespheno-vomerine*, Owen, and R. Jones.

The vomero-sphenoideus is a small muscle displayed on removing the fascia from the roof of the mouth. It arises as a small belly of muscle from a depression on the lateral plate of the parietal, close to the basisphenoid. The muscle runs forward beneath the trabeculæ cranii, and ends in a very fine tendon which is inserted on the posterior end of the vomer.

The muscle appears to be a differentiated portion of the pterygo-sphenoideus. Its action is to depress and retract the premaxilla through acting on the vomer.

Some authors have stated that they consider the muscles connected with the pterygoid and palatine bones of the snake to have no analogues in other animals. The muscles certainly present an extremely different aspect and function to the palate muscles; yet when we consider the extreme modification that the bones have undergone, we cease to wonder at the change in the

soft parts. We consider that the parieto-pterygoid represents the tensor palati; while the spheno-pterygoid represents the levator palati, the parieto-palatine being a differentiated portion of the tensor. The change in these muscles has been brought about by the position taken by the pterygoid bone, it having encroached on the region where normally the tensor and levator palati have an insertion into fibrous membrane only. Regarding the nerve supply, which is somewhat difficult to make out, the parieto-pterygoid is supplied by a nerve that issues from an aperture in the alisphenoid, and occupies such a position relative to the fifth as a nerve coming from the otic ganglion would.

The spheno-pterygoid appears to be supplied from the seventh.

SUB-OCCIPITAL ARTICULAR.

Sub-occipital articular, Dugès, Duvernoy, Owen, and R. Jones; not mentioned by D'Alton or Hoffmann.

The muscle springs from the posterior portion of the basisphenoid and the anterior part of the basioccipital. It passes outwards and backwards to be inserted on the middle third of the posterior border of the quadrate. As the muscle runs outwards it lies as a thin sheet on the posterior portion of the spheno-pterygoid muscle; while the dorsal muscles lie internal to it.

The two sub-occipital articular muscles are described as constituting an azygos muscle. There are, however, two distinct muscles, each arising as stated above. Again, the muscle is not so closely related to the quadrato-mandibular joint as the name would seem to imply.

A similar muscle is described by Sanders (25) in *Platydactylus japonicus*, and in *Liolepis belli*, whilst we have found it to be present in *Hydrosaurus*. Sanders considered it to represent the laxator tympani, while Owen compares it to the depressor tympani of fishes. We, however, think that, if the muscle is tympanic in nature, it will represent the tensor tympani.

The Dorsal Muscles.

The dorsal muscles may be divided into two groups, the mesio-dorsal and the latero-dorsal. The first consists of the spinalis and longissimus sets, the second of the sacro-lumbalis and accessorius.

Mesio-dorsal group (Humphry), *Neuro-mesial* (Owen).

The superficial fascia that covers the dorsal muscles is scanty. It is connected above with the neural spines, and from thence runs outwards over the spinalis, longissimus, and sacro-lumbalis, where it blends with the superficial layer of the external oblique.

The fascia is the representative of the external oblique stratum continued over the dorsal muscle. This is well shown in the anterior fourth of the body of *Daboia*, where the muscular fibres of the oblique layer completely replace the fascia. In the other forms examined it was only on approaching the head that the muscular fibres became conspicuous.

M. SPINALIS DORSI.

M. capito-vertebralis, Hoffmann; *Der aufsteigende Muskel zwischer den Dorn- und Gelenkfortsätzen*, D'Alton; *M. spinalis*, Hübner, Owen, Jones; *Dorn- und Halbdornmuskel*, Meckel.

The spinalis dorsi arises from the upper portion of the lateral surface of the neural spine, and from an aponeurosis which stretches between the neural spines and the zygapophysis, covering in the multifidus. Each part of the muscle runs forward as a rounded belly, ending in a long slender tendon which is inserted into the apex of the neural spine of the ninth vertebra from the origin. The tendons of the muscles are arranged so that the anterior ones lie external to, and beneath, the posterior; at the same time the tendons are connected with one another by fascia so that an aponeurosis is formed. The fascia is also modified to form a number of thecal sheaths, thus enabling the tendons to move with great facility. Tendons from the longissimus join this aponeurosis.

The muscle presents no points of difference in any of the forms examined, and the above description might apply even to the

spinalis of *Hydrosaurus*. The muscle is supplied by the internal branches of the posterior primary divisions of the spinal nerves.

M. SEMISPINALIS DORSI.

The tendons of the semispinalis arise from the flattened surface on the upper side of the postzygapophysis. Running upwards, forwards and inwards, the tendons end in well marked bundles of muscle, which fuse with the under and lateral portions of the spinalis, and so are indirectly inserted into the neural spines. The tendons of origin are closely connected with the aponeurosis covering in the multifidus beneath.

In *Morelia* in addition to the muscular bundles that are developed at the extremities of the tendons, there are a number of leaves of muscle which spring from the anterior border of the tendons, and also from the vertical aponeurosis of the longissimus. These bundles give rise to what appears to be a distinct series of muscles running between the semispinalis and the longissimus. This series is called by D'Alton, *Zweiter oder kurzer absteigender Muskel zwischen den Gelenken und Dornfortsätzen*; by Hübner, *M. spinoso-vertebrălis*; by Meckel, *Vieltheiliger Rückgratsmuskel;* by Hoffmann, *postzygapophyses-spinales.* In *Hydrosaurus* there is an intermediate arrangement between what we see in *Acanthophis* and *Morelia*, the second series becoming united with the first. We therefore consider that the bundles in *Morelia* are but specialised portions of the semispinalis proper. The internal divisions of the nerves run up and pierce the multifidus, and then lie between it and the semispinalis, supplying the latter and the spinalis, at the same time giving branches to the accessory bundles in *Morelia*.

M. MULTIFIDUS SPINÆ.

Mm. neuro-spinales, Hoffmann; *Muskel zwischen der Wirbelbogen und den Dornfortsätzen*, D'Alton.

The multifidus arises from the lower part of the lateral surface of the neural spines, immediately beneath the origins of the spinalis. It also arises from the general fascia that stretches between the neural spines and zygapophyses, separating it from

the spinalis and semispinalis above. The muscle runs forwards and outwards, the superficial fibres of each bundle pass over the vertebræ to be inserted into the lamina of the fourth, the deeper fibres being attached to the laminæ of the vertebræ passed over. The tendons of origin of the spinalis run upwards and inwards over the muscles, and are closely connected with the aponeurosis stretching between the neural spines and the zygapophyses. Each moiety of the multifidus is triangular in outline, the apex being at the spine, the base at the lamina. As the tendons of the spinalis run inwards they cross the side of the triangle nearest to them; we thus have a number of acute angular spaces formed whose floor is composed of the aponeurosis mentioned above. It is from these spaces that the spinalis dorsi arises in part.

If we consider this muscle as multifidus, we are met by the difficulty that the fibres run from the mid-line outwards. But the direction of the fibres being the result of function, and therefore necessarily inconstant in direction, we do not consider that this is a sufficient reason for not regarding the muscle as multifidus.

The relation of the nerve, running between the muscles and the semispinalis, adds to the idea of its homology with the multifidus.

In *Hydrosaurus* the muscle takes the same direction, but each bundle of fibres is in this case arranged around a strong tendon in a pinnate manner, the tendon running from the neural spine outwards to the laminæ and zygapophyses.

As we have shown, the multifidus is attached to the laminæ over which it passes, and some of the lowermost fibres consequently pass from one lamina to another only. We, therefore, get a series of small muscles which represent the rotatores dorsi. Those are described by D'Alton as "die obere Reihe zwischen den Gelenkfortsätzen;" and by Hoffmann as part of the intertransversarii. The nerve fibres pierce these muscles.

MM. INTERSPINALES.

Mm. interspinales, Hoffmann, Owen; *Zwischendornmuskeln*, Hübner, Meckel, D'Alton.

The interspinales arise from the anterior border of the neural spine, and run forwards and slightly outwards to be inserted on each side of the posterior borders of the spine immediately in front, and slightly into the laminæ leading up to the spine.

Hoffmann has described this muscle; but in the figures attached to his paper he has described as interspinales the postzygapophyses spinales.

M. LONGISSIMUS DORSI.

M. semispinalis, Hoffmann; *Der lange, absteigende Muskel zwischen den Gelenk- und Dornfortsätzen*, D'Alton; *Halbdornmuskel*, Meckel; *Longissimus dorsi*, Owen, Jones.

The longissimus dorsi arises by tendons from the processes of the anterior zygapophyses. The tendons of origin are blended together, so that a vertical aponeurosis is formed which stretches between the zygapophyses, separating the longissimus from the spinalis group, and at the same time helping to give origin to the semispinalis. As the tendons run upwards and forwards they pass into muscular bundles, which are arranged in a laminated position, the posterior overlapping the anterior.

Thus a column of muscle is formed which gives off two sets of tendons, an inner and an outer. The inner set runs towards the neural spines, and joins the tendons of the spinalis, helping by this means to form the median aponeurosis described above. The outer set serves to give origin to the sacro-lumbalis muscle, and as in the case of tendons of origin an aponeurosis was formed, so now these outer tendons are joined together, and a partition is by this means formed between the longissimus and the sacro-lumbalis. This aponeurosis reaches down to the ribs where it is attached, and so the muscle gets an insertion by this means.

The muscle by its inner tendons acts as a semispinalis; while its outer tendons can act as retractors of the ribs.

We are at a loss to understand on what ground Hoffmann and Meckel could consider this muscle as a semispinalis.

The muscle is supplied by the external division of the spinal nerves.

M. INTER-TRANSVERSARII.

M. inter-transversarii, Hoffmann (lower part); *Die untere Reihe der Gelenkfortsätzen,* D'Alton.

Belonging to the longissimus series is a small muscle which runs between the processes of the anterior zygapophysis. Some of the fibres as they pass backwards spread out over the fascia covering the levatores costarum.

These muscles correspond to the lower pair of intertransverse muscles described by D'Alton and Hoffmann; their superior intertransverse muscles we consider to be really part of the rotatores dorsi group. They are separated from the latter muscles by the aponeurosis of the longissimus tendons at their origin, and by the internal divisions of the nerve trunks, while they are separated from the levatores costarum beneath by the external divisions of the posterior portion of the spinal nerves.

Latero-dorsal group. (Humphry).

M. SACRO-LUMBALIS.

M. retractor costæ biceps, der zweibauchige Ruckwartszieher der Rippen, D'Alton; *Stratum secundum et tertium,* Hübner; *M. opistothenar,* Meckel; *sacro-lumbalis,* Owen, R. Jones.

The sacro-lumbalis is a muscle composed of two columns, an internal and an external.

The muscular bundles of the internal column arise from the aponeurosis formed by the external tendons of the longissimus muscle; they also have an origin from the tendons of insertion of the accessorius. Each bundle is somewhat flattened and runs upwards and forwards to form a column of muscles, whose external surface splits into a number of leaves which constitute the external column. The elements of this external column are inserted by means of tendons, which run downwards and forwards to the ribs at the point where the levatores costarum arise, the tendons of the two being closely connected.

In dissecting a dog at the time of writing this paper, we were struck by the similarity of the constitution of the sacro-lumbalis and accessorius in that animal with these muscles in the snake, the position of the nerves being also similar.

The external portions of the posterior primary division of the spinal nerves run up internal to the external aponeurosis of the longissimus, and giving off a branch to supply this muscle and the inter-transversarii, pierce the aponeurosis and supply the sacro-lumbalis and accessorius.

M. ACCESSORIUS AD SACRO-LUMBALEM.

Mm. praezygapophyses - costales, Hoffmann; *Gelenkfortsat-rippenmuskeln oder lange Rippenheber,* D'Alton; *Stratum quartum,* Hübner.

The accessorius is made up of a number of small muscles, each of which springs from the junction of the inner with the outer third of the ribs, and runs forwards and inwards to be inserted into the head of the third rib from the origin. These muscles are hidden from view by the sacro-lumbalis which lies above. They are not attached to the zygapophyses, as stated by Hoffmann and D'Alton.

Cranio-vertebral muscles.

M. SPINALIS CAPITIS.

M. capito-vertebralis, Hoffmann; *Der aufsteigende Muskel zwischen den Dorn- und Gelenkfortsätzen,* D'Alton; *M. spinalis,* Hübner; *Dorn- und Halbdornmuskel,* Meckel.

The spinalis dorsi is continued forward towards the head, where it is inserted on the supra- and exoccipital bones close to the middle line. The only change that is noticeable is that the muscle becomes more fleshy, the tendons of insertion into the spinous process being much smaller. Its insertion in the skull is tendinous. The continuation of the spinalis in *Diemenia* is not so well marked as in the other forms. If we follow the muscle forward we find at about the tenth dorsal vertebra, that the bundles begin to end in

rounded bellies, which are continued on by long tendons to the neural spines; the most anterior being inserted on the spine of the axis, while a few muscular fibres reaching from the axis to the skull, show that there is a continuation on of the muscle. With this arrangement in *Diemenia* we have a greater development of the complexus than in other forms. The continuation of the muscle on to the skull is no doubt accounted for by the function that it performs, it being able to draw the head well back. This is of especial value in venomous snakes, for it is by this means that the fangs are disengaged from the prey.

The continuation of the spinalis is met with to some degree in man in the spinalis cervicis muscle; and we may, perhaps, regard the fasciculi going to the complexus as part of this continuation.

RECTUS CAPITIS POSTICUS MAJOR ET MINOR, ET OBLIQUUS CAPITIS INFERIOR.

If we follow the multifidus forward we find that the bundles springing from the anterior three vertebræ are conspicuous for their size. The most anterior bundle springs by a tendon from the spine of the axis and partly from the atlas, and running as a well-defined rounded muscle is inserted on the exoccipital. This we consider to represent the rectus minor. The next bundle springing from the third vertebra is well defined, running to be inserted on the exoccipital close to the minor. This we take to be the representative of the rectus major.

The obliquus is not defined as a separate muscle, but it is plain that as the muscle bundles of the multifidus run forward and outward, that a muscle will run from the anterior spines to the lateral portion of the atlas, and so represent the obliquus inferior.

M. COMPLEXUS.

At about the tenth vertebra from the head, there are developed between the spinalis and longissimus a number of muscular bundles, which take the place of the meagrely developed semi-spinalis. The bundles arise from all the anterior vertebræ except the atlas, and coalesce to form a well-defined muscle which is

inserted on the exoccipital close to the insertion of the spinalis. In *Diemenia* the muscle is very conspicuous, and is developed in proportion to the slight insertion of the spinalis on the skull.

We consider that this muscle represents the complexus, although it is on the same plane as the semispinalis.

M. TRACHELO-MASTOIDEUS.

This muscle is formed by the continuation of the bundles of the longissimus on to the skull. The muscle is a well-defined band inserted on the exoccipital immediately beneath the squamosal bone, being partly hidden from view by the complexus.

M. CERVICALIS ASCENDENS.

This muscle represents the continuation of the accessorius and sacro-lumbalis on to the skull. As these muscles run toward the head the bundles coalesce and form a single column of muscle, which is inserted on the lower tubercle of the exocciptal, being covered by the tendon of the superior rectus anticus at its insertion.

The muscle, like the spinalis, is produced on to the head to serve a special function, since by its action it helps the snake to "strike," and afterwards helps to disengage the fangs by pulling the head first to one side and then to the other.

The Internal oblique stratum.

The internal oblique stratum comprises the greatest part of the muscles that go to make up the bulk of the snake's body. If we reflect the anterior prolongation of the sacro-lumbalis column, we come on a sheet of muscle springing from the diapophyses of the anterior vertebræ, which are without ribs. The bundles composing the sheet run backwards and outwards till they meet the first rib, whereon some of the fibres are inserted, while others are prolonged over the external surface to be inserted on the second rib. This sheet represents the scalene group. If we follow the

stratum as it runs back towards the posterior extremity, we see that true external intercostals are formed between the ribs. Of these external intercostals those fibres which are nearest the vertebræ begin first to alter their direction, so that we have formed a series of levatores costarum externi, whose fibres are directed from within, backwards, and outwards; and since the layer reaches through the whole depth of the intercostal space, we have the internal fibres similarly affected, and thus are produced the levatores costarum interni. But not only do the fibres next the vertebræ change, but also those which lie between the intercostal cartilages change from the true external intercostal direction to a more antero-posterior one. This is brought about by the cartilages of the ribs bending forward. Thus are produced the "retrahentes costarum breves" (Hoffmann). We find the arrangement described above on the first intercostal spaces; but as we go more posteriorly we find, arising from the ribs at the place where the levatores costarum interni are inserted, bundles of fibres which run outwards and backwards over two or three ribs. These are the first pretrahentes costarum superiores; and they are evidently formed by the continuation of the fibres of the external intercostals over more than one intercostal space. It is to be noted as supporting this, that they spring from where the levatores are inserted, and that where there are levatores there are no other muscles of this group overlying them. As we follow these muscles back, we find that the fibres cross more intercostal spaces until they reach their maximum by being inserted into the ninth rib from the origin, at the same time however they give slips to all the ribs crossed over. Not only have we formed a group of pretrahentes costarum superiores, but we have also an inferior group formed in the same manner, the only difference between the two being that the fibres of the inferior group, since they arise at the junction of the inner two-thirds with the outer third, must necessarily run more antero-posteriorly than the superior group.

Beside these intercostal muscles we have obliquus internus proper, and also a rectus, with its modification in the scutal muscles and the hyoid group.

PRETRAHENTES COSTARUM SUPERIORES.

Mm. pretrahentes costarum, Owen; *Intercostales superiores*, Hoffmann; *Obere, lange Zwischenrippenmuskeln*, D'Alton; *Stratum quintum*, Hübner; *Vorderer, gezahnter Muskel*, Meckel; *Great lateral costal muscles*, R. Jones.

The pretrahentes superiores arise from the junction of the inner with the middle third of the superior border of the rib, close to the point of insertion of the levatores costarum group. Each muscle runs outwards, backwards, and downwards, to be inserted into the ninth rib from the origin at the junction of the middle with the outer third. Each muscle as it passes back gives slips of insertion to all the ribs that it passes over. The muscle arises by long thin tendons which are closely connected with the tendons of insertion of the sacro-lumbalis.

Each bundle of an anterior portion of the muscle is external to a posterior bundle. The muscles, taken as a mass, form well-marked prominences on the sides of the snake, and help in a greater measure to determine the bulk of the snake. Home and R. Jones describe each bundle of these muscles as running over four ribs only; this, however, is not correct. As stated above, we believe these muscles to be modified external intercostals. The large lateral branch of the intercostal nerve that leaves the anterior of the body, is chiefly distributed to this muscle, and the next to be described.

PRETRAHENTES COSTARUM INFERIORES.

Mm. intercostales inferiores, Hoffmann; *Untere lange Zwischenrippenmuskeln*, D'Alton; *Stratum sextum*, Hübner; *Aeusserer schiefer Bauchmuskel*, Meckel; *Extension of the pretrahentes superiores*, Owen; *Great inferior costals*, R. Jones.

The pretrahentes inferiores arise from the ribs at the point where the superiores are inserted, and running back nearly parallel with the long axis of the body, they are inserted on the ninth rib from the origin. As they run back they likewise give slips to the ribs over which they pass. The muscles are sometimes described

as being continuous with the upper set; they are distinguished from the upper set by the bundles running more antero-posteriorly. They, however, appear like the superior muscles to be modified intercostals.

MM. LEVATORES COSTARUM EXTERNI.

Mm. levatores costarum, Hoffmann; *Rippenheber*, D'Alton, Hübner, Meckel; *Transverso-costal*, R. Jones; *Levatores breviores*, Owen.

The levatores costarum arise from the process extending upwards from the diapophysis, also from the rib articulating with the diapophysis. Each muscle runs backwards, and slightly downwards, to be inserted on the upper portion of the inner third of the anterior surface of the rib immediately behind. The muscle can act not only as an elevator to the ribs, but also as an external oblique muscle. The levatores costarum are wholly hidden by the sacro-lumbalis and accessorius; these, however, being separated from them by the origins of the external oblique from the lateral septum.

Each muscle is supplied by a branch from the intercostal nerves; it emerges close to the line of insertions.

MM. LEVATORES COSTARUM INTERNI.

Mm. costo-vertebrales inferiores, Hoffmann; *Innere, kleine vorwärtszieher der Rippen*, D'Alton; *Innere Rippenheber*, Meckel; *Spinoso-costales*, Hübner.

The levatores costarum interni arise from the base of the hypapophyses and from the inferior surface of the centrum. They run outwards, and backwards, to be inserted into the under surface of the head of the rib, immediately behind.

This is the arrangement in all the venomous snakes that we have examined; but in *Morelia* and other non-venomous forms the levatores costarum are large muscles arising from the hypapophyses and inserted into the third vertebra behind. The intercostal nerve runs internal to these muscles, separating them from the transverse layer.

In *Morelia* the levatores form the prominent muscular column on the inferior surface of the vertebral column when the depressores have been reflected, while the subvertebral rectus is but slightly developed. In *Acanthophis* and in all venomous forms that we have examined, the subvertebral rectus forms the prominent column, the levatores being insignificant. This peculiarity has not been before pointed out.

Mm. intercostales externi.

Mm. intercostales proprii, Hoffmann; *Zwischenrippenmuskeln,* D'Alton and Meckel; *Intercostal,* R. Jones, Owen.

The external intercostals spring from the posterior and inferior surface of one rib, and are inserted on the anterior surface of the rib immediately behind. The muscle extends from the head of the rib to the extremity, where the costal cartilages arise. The muscular fibres run from before backwards and outwards, taking the usual direction of external intercostal fibres. Between the intercostal cartilages the fibres run more antero-posteriorly, and so this portion of the muscle is usually described as though it were a distinct muscle.

On comparing this portion of the muscle to the corresponding portion in *Hydrosaurus,* we find that the same alterating in the direction of the fibres has occurred but to a less degree, and the muscle is so obviously but a continuation of the external intercostals, that we do not see the necessity for a distinct name.

Hoffmann has named these antero-posterior fibres *Mm. retrahentes costarum breves;* D'Alton, *Muskeln zwischen Rippenknorpeln;* Hübner, *Intercostales recto-decursu binas costas intercedentes;* Meckel, *Gerader Bauchmuskel;* Owen, *Rectus abdominis.*

The intercostals are covered superiorly by the levatores costarum, and the pretrahentes superiores and inferiores. Inferiorly they are separated from the depressores costarum by the intercostal nerves. The main portion of the latter pierces the muscle, so as to gain the superior surface, at a point where the depressores are inserted into the ribs, and on arriving at the surface supplies the pretrahentes group.

M. OBLIQUUS INTERNUS.

M. cutaneus internus, Hoffmann; *Der innere oder untere Bauchhautmuskel*, D'Alton; *Innerer, schiefer Bauchmuskel*, Heusinger.

The internal oblique is composed of a number of "leaves" of muscle, which arise from the external surface of the costal cartilages; and in addition a tendinous expansion spreads over the pretrahentes costarum inferiores, constituting a lateral portion of the muscle. The whole runs forward and inwards towards the mid-line, the "leaves" of muscle widen by encroaching on the lateral tendinous portion, and then fuse with the upper layer of the rectus, which is differentiated to form the scutal muscles; at the same time these "leaves" give rise to a tendinous expansion internally, which fuses with the fascia of the transversalis in the mid-line.

We do not find that an obliquus internus is described in the snake by other writers; the muscle "leaves" mentioned above correspond, we believe, with portion of the rectus as described by Humphry in *Pseudopus*. We however think, after comparing this muscle with the internal oblique of *Hydrosaurus*, that we have given its true homology.

If we follow the internal oblique forward we find it converted into the costo-mandibularis, or, as pointed out in the description of that muscle, into a muscle which represents the sterno-hyoid group.

M. RECTUS.

Hautmuskeln, Hoffmann, D'Alton.

The rectus is represented by a large mass of muscle, which is chiefly concerned in forming the scutal bundles. It consists of two layers. The inferior is composed of a broad sheet of muscle whose fibres run antero-posteriorly. This layer is inserted on to the upper surface of the ventral scutes, and is continuous laterally with the external oblique muscle. The superior layer is differentiated into special bundles, which constitute the scutal muscles proper. The several bundles occupy different planes, and have

different degrees of obliquity as regards the mid-line. Thus there is a median bundle occupying the mid-line whose fibres run antero-posteriorly. This is the M. interscutalis proprius of Hoffmann. On the other side of this are bundles whose fibres run from without inwards and forwards. These are the Mm. scutales mediales. Between these sets of muscles, and occupying a higher level, we have bundles running from within outwards and forwards. These are the Mm. pyramidales. Running from the mid-line outwards across the latter muscles, and consequently occupying a higher place, we find bundles called Mm. interscutales majores. It is with these latter bundles that the fibres of the internal oblique muscle fuse.

If we follow the rectus forward we have the deeper layer still attached to the ventral scutes, while the superior layer is converted into the hyoid group of muscles, with the exception of the mylohyoid; and we thus get portion of that stratum named by Humphry the "deep brachio-cephalic."

M. OBLIQUUS EXTERNUS.

M. cutaneus externus, Hoffmann; *Der grosse, äussere oder Seitenhautmuskel*, D'Alton; *Aeusserer, schiefer Bauchmuskel*, Heusinger.

The external oblique muscle consists of two layers. The superficial of these is continuous with the fascia covering the dorsal muscles. As we shall see later on this fascia is gradually replaced by the superficial layer as we go towards the anterior extremity of the snake. The deep layer is made up of a number of bundles which spring from the fascia representing the lateral septum, lying between the sacro-lumbalis and the levatores costarum muscles. The bundles run outwards and backwards over the pretrahentes costarum superiores, and coalescing with the superficial layer, the whole muscle is inserted on the lateral scutes, its fibres gradually fusing with the lateral portion of the rectus.

If we follow the external oblique layer forward, we find that the superficial layer which we saw represented but slightly in the posterior part of the body, now becomes conspicuous, since the

muscular bundles replace the fascia that overlay the dorsal muscles. This layer is attached to the aponeurosis formed by the tendons of the spinalis dorsi, and it is also prolonged over the head muscles and beneath the mandible. The most anterior of the fasciculi of the deep layer are attached to the quadrate. We thus have formed what is called by Humphry a "superficial brachio-cephalic stratum," which is divided again into a cervicalis superficialis superior and inferior.

The cervicalis superficialis superior has in turn a superficial portion, constituted by a platysma, and a retractor oris, depressor mandibulæ, and retractor quadrati.

The cervicalis superficialis inferior is represented by an inter-mandibularis anteriorly, and a mylohyoid posteriorly. The deep layer of the external oblique that we saw attached to the quadrate, represents the sterno-mastoid; while the whole of the cervicalis superficialis superior represents the sphincter colli of birds.

Platysma.

M. atlanto-epistropheo-hyoideus, Hoffmann; *Rückwärtszieher des Zungenbeins*, D'Alton.

The platysma is represented by a slight layer of muscular fibres extending upwards over the retractor oris, and running forward to be lost on the masseter.

The platysma is not mentioned as occurring in Ophidians; but the following facts tend to show that we are justified in considering that a platysma is really present.

In *Python bivittatus*, D'Alton found a band of muscular fibres extending from the neural spines round to the hyoid bone. We have found the same in *Morelia* and in *Hydrosaurus*; in the latter this band being but a superficial part of the well-developed platysma.

We see, therefore, the disappearance of a sheet of muscle as a whole from a class of animals in which it could obviously be of no use, but at the same time a specialised band of muscle remains, since it performs a function quite foreign to that of the platysma.

In *Acanthophis* and the other venomous snakes examined, the band was not so well developed as in *Morelia*.

Retractor oris.

Retractor oris, Humphry; *Cervico-angular*, Duvernoy; *M. cervico-mandibularis (sphincter colli)*, Hoffmann; *Trachelo-mastoideus*, Owen; *Nackenunterkiefermuskel*, D'Alton; *M. temporalis*, von Teutleben; *M. cervico-mandibularis*, Cuvier.

The retractor oris arises from the aponeurosis of the spinalis attached to the anterior three or four neural spines. Running forward, outwards, and downwards, over the digastric and posterior portion of the articular, the muscle ends in a tendinous expansion inserted into the symphysis of the lips and the integument adjoining.

In *Daboia* and *Morelia* this muscle divides into two layers as it runs forward, the deeper one being inserted into the articular, the superficial having the same arrangement as in *Acanthophis*.

The muscle may represent a zygomaticus major. It certainly corresponds to the retractor portion of the cervicalis superficialis of *Lepidosiren* and the dogfish, as pointed out by Humphry. On the other hand, it corresponds to part of the sphincter colli of birds.

The muscle acts as a tensor of the symphysis of the lips, thus enabling the inferior portion of the masseter to work with a "pully-like" action round the symphysis. Some of its fibres also pass on to the capsule of the venom gland, thus serving to steady the gland when the masseter is contracting on it.

M. retractor ossi quadrati.

M. retractor ossi quadrati, Hoffmann; *Rückwärtszieher des quadratum*, D'Alton; *Filum musculare s.-tendinosum* (?), Hübner.

This small band of muscle springs by a very delicate tendon from the posterior portion of the upper extremity of the quadrate. Running backwards and downwards the tendon gives way to a muscle which passes beneath the retractor oris but lies on the

depressor mandibulæ. When the muscle reaches the costo-mandibularis, its fibres spread out and are lost over this latter muscle.

The muscle represents a portion of the sphincter colli of birds.

DEPRESSOR MANDIBULÆ.

M. depressor mandibulæ, Humphry; *Neuromandibularis*, Duvernoy, Owen, R. Jones; *M. cervico-hyoideus* (in part), Hoffmann; and *Nackenzungenbeinmuskel*, D'Alton.

The depressor mandibulæ arises from the aponeurosis attached to the neural spines of the sixth to the twelfth vertebræ. The muscle runs forward as a broad sheet over the pretrahentes costarum superiores, and the deep bundles of the external oblique, then bending beneath the end of the mandible it is joined by the costo-mandibularis, and thereupon becomes mylohyoid.

In *Daboia* and *Pseudechis* the muscle is intersected by two tendinous bands running from the hyoid bone outwards towards the end of the mandible. In these cases the muscle is quite separated from the mylohyoid.

Humphry describes in *Pseudopus* one band occupying the position of the posterior one here, and he remarks that Reudinger supposes it to represent an acromion. From what we have said above we regard these bands as part of the cornua of the hyoid.

The muscle is separated from the retractor oris, by a slight interval, as it approaches the quadrate. This is explained on referring to *Hydrosaurus* where we see the external auditory apparatus occupying the interval.

This muscle also corresponds to part of the sphincter colli of birds.

M. MYLO-HYOIDEUS.

M. mylohyoideus, Hoffmann; *Kieferzungenbeinmuskel*, D'Alton; *Latissimus ingluviei, s. platysma myoides*, Hübner; *Hautthalsmuskel*, Meckel; *Costo-mandibularis*, Owen.

The mylohyoid, as mentioned above, is formed by the coalescing of the fibres of the depressores mandibulæ and costo-mandibulæ. The muscle may be said to arise from the ossified part of the hyoid, and from the tendinous intersections when they are present. Running forward the muscle meets its fellow of the opposite side in the median line, while laterally it is inserted on the inferior surface of the mandible, between the temporal muscle above and the pterygoid below, reaching as far forward as the dentary. The muscle forms a floor which hides from view the superior muscles together with the nerves and vessels.

From its origin at the hyoid bone the muscle is able to protract the lingual sheath and so act on the tongue, thus resembling a genio-hyoid function.

M. INTERMANDIBULARIS.

M. intermandibularis, Owen, Duvernoy; *Die sich kreuzen den Muskeln des Unterkiefers*, D'Alton; *Cervico-hyoideus* (in part), Hoffmann.

This muscle springs from the lower border of the anterior two-thirds of the dentary. The fibres run inwards and backwards to the mid-line, where they meet the fibres of the opposite side. At their junction a well marked median raphe is formed. These muscles are evidently but portions of the mylohyoid, whose fibres have changed their direction with their corresponding change in function, *i.e.*, to bring the divaricated mandibles together. In *Hydrosaurus*, where the muscles could be of no use in this respect, the fibres of this region are specially modified to serve as compressors of the sublingual glands. In *Acanthophis* a small band is detached from the upper surface which winds round each sublingual gland and performs this function. This band was first pointed out by Leydig.

From the posterior portion of the muscle a well marked band of fibres runs back. It lies above the mylohyoid, and is inserted into the inferior surface of the mandible. In *Daboia* it is connected with the anterior fibrous intersection. It may represent a cerato-mandibular as seen among lizards.

M. COSTO-MANDIBULARIS.

M. costo-mandibularis, Duvernoy, Jones and Owen; *included in the Cervico-hyoideus* of Hoffmann and D'Alton.

The costo-mandibularis is formed by plates of muscle which spring from the costal cartilages of the third to the tenth rib. These bundles correspond to those described as forming posteriorly the internal oblique proper. Instead of being inserted into the superior layer of the rectus, the bundles are collected into a sheet which runs forward above the fibres of the depressor mandibulæ, and coalesces with them, helping to form the mylohyoid, at the same time becoming inserted into the hyoid bone.

In *Daboia*, however, where the tendinous intersections occur, these bundles are inserted into the posterior tendinous band, and thus represent a sternohyoid muscle.

Hoffmann has followed D'Alton in describing this muscle as part of the depressor mandibulæ, but from its formation and relations, it clearly belongs to the middle and not to the external stratum.

From its insertion into the hyoid the muscle can act as a retractor of the lingual sheath and tongue, thus resembling the action of the sternohyoid.

By its continuation into the mylohyoid, and so indirectly on to the mandible, it can act as a depressor of the lower jaw.

M. HYO-GLOSSUS.

M. hyoglossus, Hoffmann, Owen; *Zungenbeinmuskel*, D'Alton.

The hyoglossi come into view when the mylohyoid is reflected. The muscles arise as two rounded bellies from the inner side of the ossified hyoid rods. Running forward the muscles coalesce, and are continued as one muscle into the lingual sheath, where they join the intrinsic muscles of the tongue.

These muscles are generally taken to represent the hyoglossi, but it is doubtful if this is their true homology. Owen is certainly

wrong when he describes the whole tongue as composed of hyoglossi. In *Pseudechis* the muscles arise from the anterior third of the hyoid bones, while at the posterior third there is an interhyoid muscle; the hyoid bones in this species being remarkable for their length. The muscles are similar in *Hydrosaurus* to those described above.

M. GENIO-HYO-GLOSSUS.

M. maxillo-hyoideus, Hoffmann; *Genio-hyoideus*, Meckel; *Vorwärtszieher des Zungenbeins*, D'Alton; *Genio-hyo-glossus*, Owen; *Genio-vagiens*, Duvernoy.

This muscle arises by two heads—the external from the junction of the anterior with the middle third of the dentary, the internal from the median raphe of the intermandibularis. The two heads running backwards and inwards coalesce, and are inserted on the lingual sheath, and on the anterior portion of the hypobranchial rods.

These muscles are the main protruders of the tongue. The corresponding muscles in *Hydrosaurus* resemble these very closely.

M. GENIO-TRACHEALIS.

M. genio-trachealis, Owen, Duvernoy; *Maxillo-laryngeus*, Hoffmann; *Vorwärtszieher des Kehlkopfes*, D'Alton.

The genio-trachealis is a small band of muscles arising from the same spot as the outer head of the genio-glossus. It runs backwards and inwards to be inserted on the side of the trachea; at the same time some fibres spread out on the lingual sheath and the floor of the mouth.

This muscle appears to represent a dismemberment of the genio-glossus. The muscle is present in *Hydrosaurus.* The action of the muscle is to protrude the trachea while the animal is passing a large prey through its gape.

M. HYO-TRACHEALIS.

M. hyoideo-laryngeus, Hoffmann; *Rückwärtszieher des Kehlkopfes*, D'Alton; *Retrahens laryngis*, Hübner.

The muscle arises from the anterior portion of the hyoid rod, and runs forward to be inserted into the floor of the mouth close to the insertion of the genio-trachealis, while many of its fibres are attached to the trachea.

This muscle is probably a dismemberment, like the genio-trachealis, of the genio-glossus.

The Transversalis Stratum.

The transversalis stratum of the ventral muscle is well developed in snakes. If we lay open the abdomen, and turn aside the intestines, we see a well marked column of muscle lying on either side of the hæmal spines, whose fibres run forward and outwards; the columns are composed of the depressores costarum. On removing these muscles, we come on a levator layer, running from before backwards; these represent a subvertebral rectus. On either side of the depressores, we have the transversalis muscle and fascia lying in a sheet beneath the ribs, and hiding from view the retrahentes costarum running from before, backwards, and outwards. We do not find any internal intercostals, their place being taken by the depressores and retrahentes, which we regard as greatly altered internal intercostals.

If we trace the depressores forward we find them being converted into longus colli and rectus capitis anticus.

M. TRANSVERSALIS.

M. abdominis externus et internus, Hoffmann; *Der äussere Bauchmuskel, und der innerere Bauchmuskel,* D'Alton; *M. transversalis*, Owen.

The transversalis muscle proper is represented by two sheets of muscle, which spring from the junction of the outer with the inner half of the inferior surface of the ribs, just external to the insertion of the depressores costarum. Two layers composing the transversalis run downwards and inwards, the muscular fibres gradually giving place to a strong tendon which meets its fellow of the opposite side along the middle ventral line.

In the non-venomous snakes, with the disappearance of the hypapophyses, the transversalis is continued inwards as a sheet of fascia, containing a slight amount of muscular tissue, and is inserted on the anterior common ligament, coalescing with the fascia that gives origin to the depressores costarum in this region. We see therefore that the transversalis very distinctly arises from the vertebral column in non-venomous snakes, and that in venomous snakes the very slight layer of fascia found beneath the depressors is the representative of this sheet, which corresponds to the anterior lamella of the tendon of origin of the transversalis in higher animals.

With regard to the two sheets of muscle bundles making up the main body of the muscle, the external one has its fibres arranged in bundles, the direction of the fibres being from without inwards and forwards, corresponding to the direction of the retrahentes costarum, and therefore having such a direction as a subcostal group of muscles would take. The layer corresponds with D'Alton's *äussere Bauchmuskel.* The inner layer has its bundles of fibres placed in a direction corresponding to a true transversalis muscle.

M. DEPRESSORES COSTARUM.

M. costo-vertebrales superiores, Hoffmann; *Innerer, grosser Rückwärtszieher der Rippen*, D'Alton; *Costales interni superiores*, Hübner; *Transverso-costal*, R. Jones; *Retrahentes costarum*, Owen.

The depressores costarum arise from the extremities and sides of the hypapophysis. The muscular bellies coalesce at their origin, and then run forwards and outwards, each to be inserted by a tendon on the middle of the posterior border of the fourth rib from the origin, at the same time giving slips to the ribs over which they pass. This is the arrangement in venomous snakes, but in *Morelia* a considerable change takes place with the disappearance of the hypapophysis. Instead of the muscular bundles arising directly from the vertebræ, they now arise by means of a strong aponeurosis attached to a well marked anterior common

ligament, stretching between the tubercles representing the hypapophyses. Along with this mode of origin we have also a change in the appearance of the muscles, which now have the appearance of a number of quadrilateral plates, and these do not form such a prominent column as when the muscles arise from the well developed hypapophyses. The muscles are separated from the internal levatores costarum by the intercostal nerves; while below or internal to it is the vertebral fascia of the transversalis muscle. These muscles are present in all the lizards that we have examined, *Hydrosaurus*, *Calotes*, *Hinulia*, etc.

St. George Mivart describes them in *Menopoma alleghaniense*, adding the remark that "the muscle gets thinner and smaller backwards, but anteriorly it enlarges and passes in a fleshy mass beneath the skull." He also describes them in *Iguana tuberculata*, while Sanders mentions them in *Platydactylus japonicus*. Humphry describes them in *Cryptobranchus* and *Pseudopus*. The lower part of the longus colli in higher animals shows us the cervical representatives of these muscles. The arrangement of the origin of different parts of this muscle may offer some explanation as to the varying length of the hypapophyses.

Subvertebral Rectus.

The bundles of fibres which compose the subvertebral rectus spring from the sides and the bases of the hypapophyses, and running backwards and slightly outwards are inserted into the parapophyses of the third vertebra from the origin. The bundles are well marked in venomous snakes, but are but slightly developed in the non-venomous forms. The muscles are separated from the levatores costarum interni by the intercostal nerves; whilst they lie on the depressores costarum beneath.

We can find no reference to a subvertebral rectus as occurring in snakes, as it seems that this muscle has generally been taken along with the levatores costarum interni. That it belongs to a different group of muscles is evident from the relation of the intercostal nerves to it.

Mm. retrahentes costarum.

Mm. retrahentes costarum longi, Hoffmann; *Innerer, kleiner Rückwärtszieher der Rippen*, D'Alton; *Costales interni inferiores*, Hübner; *Retrahentes costarum inferiores*, Owen.

The retrahentes costarum arise from the anterior border of the ribs at the junction of the inner three-fifths with the outer two-fifths. The flat quadrilateral bundles run forward and inwards, passing over three ribs to be inserted into the fourth at the place where the sternal cartilages join the ribs, at the same time giving slips to the ribs passed over. The muscles are separated from the external intercostals by large branches of the intercostal nerves; while they are also separated from the transversalis muscle proper by branches from the intercostal nerves.

These muscles most probably represent modified internal intercostals, combined with subcostals.

M. rectus capitus anticus.

M. rectus capitis anticus major et minor, Hoffmann; *Der grosse, untere, und der kleine, gerade Kopfbeuger*, D'Alton; *Der gerade Seitenmuskel des Kopfes order Seitwärtsbeuger*, Meckel; *Rectus capitis inferior*, Hübner; *Longus colli*, Owen; *Transverso-spinalis inferior*, Jones.

The rectus anticus is formed by the forward extension of the depressores costarum. These muscles as they approach the head divide into a superior and inferior layer. The inferior layer is formed thus:—the various bundles instead of running outwards and forwards to be inserted into the ribs, run inwards and forwards, and coalesce to form a single column of muscle which is inserted into the tubercle on the basioccipital bone close to the median line.

The superior layer still continues to have its bundles inserted on the ribs, until it reaches to the fourth vertebra, when the bundles coalesce and a second column of muscle is formed similar to the first, but running outwards and forward to be inserted into the lower tubercle of the exoccipital.

The first of these columns is called by Hoffmann the "rectus anticus major," and the second one the "minor." The only objection to be offered to this is the fact of the different directions of the muscles, since they run from within outwards instead of from without inwards.

The form of these muscles is similar in all the snakes examined, and is much the same in *Hydrosaurus*. The reason for this great development is to be found in the fact that they are the main muscles by which the snake "strikes."

M. LONGUS COLLI.

The longus colli is not described in snakes, although we shall show that it is really represented.

The muscle which we have described above as the subvertebral rectus is continued forward to the skull. The first bundles spring from the basioccipital and run backwards to the hypapophysis of the atlas. This muscle might be described as a rectus medialis, but it is not met with in the higher forms, its place being occupied by the accessory ligament of the anterior occipito-atlantal. The succeeding bundles spring from the hypapophyses, and run outwards and backwards, thus resembling the longus colli; more posteriorly we have the subvertebral rectus, developed to a different degree in various forms, as we have shown above.

The Muscles of the tail, penis, and anus.

On reflecting the integument from the posterior portion of the body, we find that the columns of the spinalis and longissimus muscles are continued back to the extremity of the tail, while the sacro-lumbalis becomes much reduced, and is represented by a small band of muscle only. The bundles of the external oblique end immediately anterior to the anus, while the pretrahentes costarum superiores and inferiores run back to the last rib, where they coalesce with the bundles of the flexores caudæ. Posterior to the anus we have the flexor caudæ superficialis springing from the costo-transverse processes. The muscle meets its fellow of the

opposite side in the mid-line below, and together they are prolonged forward, giving off tendons of insertion to the costo-transverse processes. Before reaching the anus they diverge, enclosing a space in which is seen the retractor cloacæ, and running forward they are inserted on the last rib, becoming continuous with the pretrahentes costarum. The layer of muscle appears to be on the same plane as the internal oblique stratum.

On reflecting this layer we come on the transversus penis and flexor caudæ profundus. The latter muscle is composed of a number of bundles springing from the costo-transverse processes; those run forward, and are inserted on the more anterior processes. The transversus penis is a well-marked sheet of muscle; the bundles arise from the hypapophyses, and run inwards and backwards, being attached to the penis, while they meet the bundle of the opposite side in the mid-line below. The nerves lie external to this layer.

On reflecting the transversus penis we find the retractor cloacæ and sphincter cloacæ, together with the penis and its retractor.

The retractores cloacæ are two columns of muscle lying on either side of the mid-line. The bundles arise from the hypapophyses, and running forward fuse with the fibres of the sphincter ani posteriorly.

External to these muscles lies a penis on either side with the retractor penis at its posterior extremity, springing from the hypapophyses.

A sphincter ani surrounds the anus, while on either side of this, external to the penis, is an elongated sphincter cloacæ. Lying above the retractor cloacæ and penis is a well marked layer of muscle, composed of bundles running from the hypapophyses backwards and outwards to the inferior costo-transverse processes. These muscles are in series with the subvertebral rectus described above.

The Spinal Nerves.

The spinal nerves emerge from the foramen formed by the notches at the bases of adjacent laminæ. They divide in the usual manner into anterior and posterior primary divisions.

The posterior primary division runs outwards for a short distance, and divides into an external and internal branch.

The external branch runs backwards and upwards, winding round the pedicle of bone supporting the prezygapophysis, between, therefore, the superior facet of the transverse process, and the tubercle of bone above. Passing under the origin of the levatores costarum externi, it ascends and pierces the fibres of the rotatores dorsi, which lie between the zygapophyses; supplying these muscles, it then comes to lie between the semispinalis and the multifidus, to each of which it gives a branch, and ultimately is lost in the spinalis dorsi.

The external branch runs upwards and outwards, and, winding round the internal side of a levator costæ externus, it comes to lie on this muscle, and beneath the longissimus to which it gives a branch. After this it pierces through the aponeurosis formed by the tendons of insertion of the longissimus, and breaking up into branches is lost in the sacro-lumbalis column.

The anterior primary division is a larger trunk than the posterior. It runs outwards between a levator costæ internus above, and the subvertebral rectus below (internal), thus separating the internal oblique stratum from the transverse. Soon it gives off two branches, one going to each levator costæ externus, the other to a levator internus.

The main branch runs outwards between the external intercostals and the depressores costarum. It gives off a well marked branch which supplies the depressores costarum, and a little more externally it supplies the transversalis muscle with a large twig which runs between the retrahentes costarum and the transversalis. When the main trunk reaches the point where the depressores are inserted it divides into two divisions. The larger of

these two runs outwards between the external intercostals and the retrahentes costarum to each of which it gives branches, and then ends by supplying the pretrahentes costarum inferiores. The smaller of the two divisions, corresponding it would seem to the lateral cutaneous branches of other animals, pierces the external intercostals, and running outwards over the pretrahentes costarum superiores, and beneath the external oblique, it gives to each a branch and then continues on to reach the rectus and scutal muscles.

The Venom Gland.

When the integument is removed from the side of the head, portion of the lateral surface of the gland is displayed lying between the masseter above, and the superior labial glands below.

The superior surface is covered by the masseter; the inferior rests on the anterior part of the pterygoid muscle, the transverse bone, and the dense fascia which stretches between the pterygoid bone and the edge of the lip, and portion of the palatine aponeurosis. Internally the gland is related to the descending portion of the masseter, and is separated from the lachrymal gland and the parieto-palatine muscle by the suspensory ligament of the gland. Posteriorly it is separated from the anterior temporal muscle by another ligament.

The gland is obovate in shape, the anterior extremity being produced into the venom duct. It is surrounded by a dense fibrous capsule, which is also continued over the duct. This may be the representative of the true "parotid fascia." It is to this capsule that the masseter muscle is attached. A strong band of fascia springs from the external and posterior portion of the gland, and running back is inserted into the capsule of the quadrato-mandibular joint, and on the posterior and external ridge of the articular. This band has been named by Dugès the "zygomatic ligament," and he regards it as the representative of the zygomatic arch of birds. In the non-venomous species this band springs from the maxillary bone. It is also present in *Hydrosaurus.*

The capsule of the gland is continued into special bands of fascia, which form ligaments for its support. The best marked of these bands is the anterior, which springs from the fore part of the inner surface of the gland capsule, and is inserted on the post-orbital bone, and on the orbital portion of the lateral plate of the parietal. Immediately behind this, the fascia which lies on the internal pterygoid muscle fuses with the fascia of the capsule along portion of its inner surface. Posteriorly and internally there is a well-marked band continued down from the capsule to the symphysis of the lips; here to be connected with the foremost fibres of the retractor oris muscle.

The capsule may be stripped off the gland with a little dissection, and we then come on an internal capsule, which is intimately connected with the proper substance of the gland.

The duct of the venom gland springs from its anterior extremity, and bending forward and outward runs in a groove on the lateral face of the maxillary bone until it reaches its anterior margin, around which it bends to end in a papilla, which is in relation to the small lacuna in the groove upon the anterior surface of the fang. There is no sigmoid curve in the duct, as there is in many vipers. The minute structure of the venom gland has been examined by Emery (No. 6), and presents nothing remarkable.

Mitchell (No. 18) has described an enlargement in the duct of the venom gland of *Crotalus*, which he considers to be a sphincter muscle. He says, "the elements [of the enlargement] are undoubtedly the characteristic cells of non-striated muscular tissue. Their presence together with the form and position of the enlargement restraining the wasteful flow of the secretion."

There is no enlargement in the duct of *Acanthophis*, or any of the other forms examined, but we are not prepared to say whether any muscular fibres are present. We should think that such an arrangement would be likely to occur in all venomous snakes.

The Lachrymal Gland.

The lachrymal gland is a small oval body lying on the posterior and on the internal surface of the orbit. It is hidden from view by

the anterior suspensory ligament of the venom gland; while it is related by its inferior surface to the parieto-palatine muscle. The gland does not project backwards out of the orbital fossa as in the non-venomous forms; nor does the masseter muscle give any fibres to act as a compressor, as we find in the non-venomous forms.

The Labial Glands.

The superior labial gland is represented by a number of follicles placed along the superior labium. It meets its fellow of the opposite side anteriorly, while it is continuous at the symphysis of the lips with the inferior labial gland. This runs along the edge of the inferior labium, and anteriorly meets its fellow of the opposite side.

Sublingual Glands.

The anterior sublingual glands are two in number. They are placed above the genio-hyo-glossus, and the inter-mandibularis, and are immediately in front of the opening for the tongue on the anterior portion of the floor of the mouth, into which they open by numerous ducts. Posteriorly a muscular band embraces the gland. This is derived from the inter-mandibularis, and is called the "Vorwartszieher" of the gland by Leydig (No. 16). A band of muscle proceeding from the posterior extremity corresponds to his "Rückwärtszieher." In *Hydrosaurus* the whole of the inter-mandibularis is utilized in forming a compressor for the large sublingual glands. A well marked posterior sublingual is present immediately behind the anterior ones.

In comparing the relative state of development of the glands in *Acanthophis* with the development in *Morelia* and other forms, we have come to the same conclusions as Duvernoy (No. 5).

He was the first to point out that, in the Aglyphodontians we have the superior and inferior labial glands, as well as the lachrymal gland, very extensively developed. That in the Opisthoglyphians we have the glands relatively smaller, and a venom gland begins to be developed. In the Proteroglyhphians we have

the lachrymal gland quite small, while the labial glands have also decreased, but that along with these changes we have a large venom gland. Lastly in the Solenoglyphians we have a small lachrymal, while the labial glands may even disappear, or be but slightly represented, but that we have a very much larger venom gland than is found in any of the other forms.

What conclusions do these facts tend towards? That since the non-venomous snakes are so plentifully supplied with glands about the mouth, whose function, it is generally conceded, is mainly that of lubricating the prey, how does it come about that the venomous snakes lubricate their prey, and yet have but slightly developed labial, lingual, and lachrymal glands? The answer will fall under one of these heads. Firstly, that the glands are sufficient for the purpose; secondly, that there are mucous glands diffused throughout the mouth; or thirdly, that the venom gland aids in the lubrication. In answer to the first proposition, we maintain that the glands are not sufficient for the purpose, for while moderately well developed in some venomous forms, they are abortive or almost so in others. To the second question, as to the presence of diffused mucous glands, we are not aware that they have been described. To the third question we now come with considerable diffidence. We are fully aware how much has been written against the view that the venom gland is a salivary gland in function, but we nevertheless incline to the belief that, not only does the venom serve to lubricate the prey, but that it even helps to digest it.

It is not our intention to go into this subject in this paper, but out of the many facts that we might urge in support of our view, we will take a single one as the result of our own experiments.

The experiment, we have since learnt, had been tried by Weir Mitchell some years ago. He says: "The final influence of venom upon the muscular structure was extremely curious. In every instance it softened it in proportion to the length of the time during which it remained in contact with it, so that after even a few hours in warm-blooded animals, and after a rather longer time in a frog, the wounded muscle became almost diffluent,

and assumed a dark colour and somewhat jelly-like appearance." Our experiments were mostly on fresh muscle, and in all cases the peculiar softening alluded to by Mitchell occurred, and the muscle could be easily broken up into a somewhat granular-like mass. We cannot say that the changes that take place are those of digestion, but the fact remains that the muscle is profoundly altered from a physical point of view; and if the change is not one of direct digestion, it nevertheless aids that process by the altered condition.

The most obvious objections to be urged against these views are, that a large quantity of the venom would be necessary, and that such a quantity would endanger the life of the snake.

We admit that the first objection is a strong one; with regard to the second, as to the effect of the venom on the snake itself, the results of the various investigators are so contradictory that the objection for the present must remain unanswered.

The Mechanism of the Bite.

In considering the various points connected with the bones and muscles in the mechanism of the bite of venomous snakes, we enter upon a field which has been gone over many times; and yet we think that there is room for new observations. Weir Mitchell has given an excellent account of the mechanism of the bite in his paper on *Crotalus;* but he nevertheless has missed several important points; and, in addition, he himself admits that he has not given an account of all the muscles concerned in the various movements; and lastly, the nomenclature which he has applied to the muscles and bones concerned, is in many instances quite different to that which we shall adopt.

We shall consider the bones which take part in the erection of the fangs.

The prefrontal is hinged to the frontal by a ginglymus joint. This joint is so constructed that the prefrontal may have an up-and-down movement. Owing, however, to the anterior face of the frontal running from within, outwards, and backwards, the

prefrontal moves upwards and outwards, the lower portion coming also forward. This lower border rests on the superior surface of the maxilla which is, however, only slightly concave. Usually in venomous snakes there is a well marked ball and socket joint developed between these two bones, and accordingly considerable motion is possible; but in the case of *Acanthophis* the greatest movement takes place between the frontal and prefrontal. This probably misled Krefft when he described the fangs as being permanently erect. The transpalatine articulates with the posterior extremity of the maxilla by a concavo-convex surface, while it is immovably fixed to the pterygoid by its posterior extremity.

The palatine is fixed to the anterior extremity of the pterygoid by a ginglymus joint which allows considerable upward movement. The pterygoid is loosely attached to the articular and quadrate by ligaments, but there is not that close adhesion of the bones that is said to occur in *Crotalus*, for instance.

The mandible is attached to the quadrate by a ginglymus joint, closely resembling that of the human elbow. The quadrate stretches outwards, backwards, and slightly downwards, so as to carry the posterior extremity of the mandible from the middle line. The superior extremity of the quadrate articulates with the squamosal by a large flattened surface, which allows of moderate movement. The squamosal is firmly fixed to the side of the skull, and is capable of only slight, if any, movement.

The digastric acting on the posterior extremity of the mandible in such a manner that the jaw is turned into a lever of the first order. Owing to the length of the mandible from its anterior extremity to the articular surface, and the shortness of the posterior portion to which the muscle is attached, extended movement is gained with loss of power. When, however, the mouth is closed by bringing the mandible upwards, the lever is of the third order, great power being gained by the insertion of the muscles along the upper and middle portions of the bone.

Since the mandible is carried outwards posteriorly, while it is close to the middle line in front, it follows that, when the mandible

is depressed anteriorly, it will move downwards, outwards, and backwards, and by this means a wide gape is attained; this is aided by the fact that the mandible is concave above from before back.

With regard to the movements of the head on the atlas we have seen that, while downward movement is easy, upward movement is limited by the close apposition of the exoccipital to the atlas. This is a decided advantage, for the snake when striking is able to steady its head against the atlas by contracting the dorsal muscles prolonged on to the skull. And again, since the muscles which enable it to strike are attached to processes on the basi-occipital, it follows that the head is acted on like a lever of the second order, the fulcrum being at the anterior face of the atlas; thus dislocation downwards of the occipital condyle is prevented by resting on the flat surface of the atlas, and by the exoccipitals meeting the anterior borders of this bone in the manner described above.

We now come to a point which is of considerable interest. Huxley and many others have described the erection of the fangs as the result of the action of the quadrate on the pterygoid bone, leaving out of the process the action of the special muscles which we have described above. Huxley says:—"When the animal opens its mouth for the purpose of striking its prey, the digastric muscle pulling up the angle of the mandible, at the same time thrusts the distal end of the quadrate forward. This necessitates the pushing forward of the pterygoid, the result of which is twofold; firstly, the bending of the pterygo-palatine joint; secondly, the partial rotation of the maxillary upon its lachrymal (pre-frontal) joint, the hinder edge of the maxillary being thrust downwards and forward. In virtue of this rotation of the maxillary through about a quarter of a circle, the dentigerous face of the maxilla looks downwards and even a little forward, instead of backwards, and the fangs are erected into a vertical position."

While we agree with the above description in regard to the actual movements of the bones, we unhesitatingly say, that the supposed means by which these movements are brought about are

not the true ones, but that the fangs are erected through the action of special muscles on the pterygoid bones. The observations of Weir Mitchell on this point entirely agree with our own, namely, that the mandible may be depressed and the mouth opened to any width without necessitating the erection of the fangs. He has further shown that by stimulating the special muscles attached to the pterygoid bones, erection of the fangs took place. Observations made on the dry skull are misleading, and tend toward the theory advocated by Huxley.

We will now follow the snake through those complex movements which take place when a prey is struck. A snake approaches its prey with movements which are almost imperceptible, since they are made of numerous small motions which are rendered possible by the great differentiation which has taken place in its body. When it deems that it is sufficiently close to its prey it begins the following movements :—the head and the anterior vertebræ are raised somewhat from the ground, and the head is brought back so that the exoccipitals are placed in apposition with the atlas, which in turn is jammed against the axis. This is brought about by the contraction of the dorsal muscles, which are produced on to the skull. At the same time some of the anterior vertebræ are so bent that they form a slight bow with the convexity forward.

While this has been taking place the digastric contracts, and pulling on the posterior extremity of the mandible, rotation takes place round the quadrato-mandibular joint, and the anterior portion of the mandible is depressed. The digastric is aided in this action by the depressor mandibulæ, and the costo-mandibulæ and mylohyoid attached to the inferior and anterior portion of the mandible. Along with the opening of the mouth the fangs are erected by the spheno-pterygoid and the parieto-pterygoid ; the one acting above, the other below, draw forward the pterygoid, which leads to the rotation of the maxilla and prefrontal, since the transpalatine attached to the pterygoid shares with this latter bone its forward motion, and consequently being also attached to

the maxilla this bone moves slightly on the prefrontal, which in turn moves forward and upward, since it is articulated by a joint with the frontal.

Mitchell says that the spheno-pterygoid alone erects the fangs by acting on the pterygoid, but this is an error, as the parieto-pterygoid shares largely in this action.

The snake is now ready to strike. With head firmly fixed, mandibles depressed, and fangs erect, the blow is struck by the sudden contraction of the rectus capitis anticus group of muscles, which are attached to the processes on the basi-occipital, and also by the contraction of the sacro-lumbalis group prolonged to the side of the basioccipital. The fangs enter in a downward and outward direction, and the jaw is closed by the contraction of the masseter, temporal, external pterygoid, and parieto-mandibularis muscles, along with which action the poison is injected through the contract ion of the masseter on the gland. The squeezing of the gland is brought about thus :—the superior, or superficial, portion of the masseter contracting, pulls forward the posterior extremity of the gland; this action, however, is opposed by the strong zygomatic ligament attached to the gland externally and posteriorly. If now the inferior portion of the masseter contracts, the gland will be pulled downwards; this is opposed by the suspensory ligaments and by the integument below and externally made tense by the contraction of the retractor oris muscle; and also by the internal pterygoid, which is now contracting in order that it may pull the fangs more deeply into the wound. Thus opposed on all sides the gland is squeezed by the masseter most effectually. Now that the fangs are deeply sunk in the wound, and the solid teeth of the palatine are also driven in, the snake, if it no longer wishes to hold its prey, proceeds to extricate its teeth. This is not always an easy matter, and frequently the head is rotated from side to side in order to loosen the too firm hold. This rotating action is evidently largely aided by the insertion of the longissimus and sacro-lumbalis groups in the skull. If, however, the snake can disengage itself without any difficulty, it does

so by relaxing the internal pterygoid, and contracting the parieto-palatine muscle and the spinalis group; the latter pulling the head upwards and backwards, while the parieto-palatine tends to do the same for the palatine bone, which coming into contact with the maxilla helps to raise that bone, and so aids in extricating the fangs. When the fangs are once more free, the internal pterygoid contracts, and pulling back the transverse and pterygoid bones depresses the fangs; the parieto-palatine aiding in this by drawing back the palatine. The fold of mucous membrane which surrounds the fangs slips up to the base of the fangs when these are erected. When depressed the mucous folds again regain their former position. This is described in *Crotalus* as being brought about by a slip of muscle from the pterygoid being attached to the folds. In *Acanthophis*, however, the parieto-palatine sends forward a slip which aids in this action. The chief element, however, appears to be some elastic fibres which are contained in the membrane, and when the fangs are erected these are put on the stretch; but when the fangs are depressed the fibres assume their former state, and so the membrane is brought back over the fangs.

In the non-venomous snakes the muscles attached to pterygoid bones and palatine act so as to draw the bones forward or backwards, as the case may be. By this means the prey is drawn gradually into the mouth.

Movements of the Vertebræ.

In regard to the movements of the spinal column, we have to deal with no less than ten articular surfaces for each vertebra. Two each on the zygosphene and zygantrum, two pre- and post-zygapophyseal, and the ball and socket of the centrum.

Taking two vertebræ that are articulated to one another, we see the postzygapophysis of the anterior resting on the prezygapophysis of the posterior, the zygosphene of the second with its facets in the zygantrum of the first, and lastly, the ball of the anterior resting in the socket of the posterior.

If now the anterior one be moved so that its front portion turns to the left, while its hinder extremity goes to the right, we shall observe the following order of events:—the postzygapophysis of the right side moves outwards and forwards; this brings the articular facet, with the projection on its posterior edge, (*vide supra*) forward, so that the facet rests mainly on the projection on the anterior edge of the prezygapophysis beneath. There is no obstacle to the movement of this zygapophysis in an outward direction beyond that offered by the ligaments. Meanwhile the postzygapophysis on the left side has moved inwards and backwards. This brings the facet, with its projection on the posterior edge, backwards and inward, and the projection now coming into contact with the sides of the lamina prevents any further movement in that direction. If we had had another vertebra in front of our anterior one, we of course would have found that it was the right anterior zygapophysis that was stopped in its motion by coming into contact with the pedicle of the front vertebra.

Thus if we represent the points of movement as taking place at the angles of a square, we shall see that at the two extremities of one diameter we have an obstacle to further motion, while at the extremities of the other diameter we have comparative freedom.

To these considerations we must now add the movements of the zygosphene and zygantrum. With regard to these, the same side that received a check above, will receive one now. And if we add to this the opposition afforded by the ball and socket joints of the centrum, we shall see that whenever one vertebra of a series moves from side to side, its movement becomes limited by bone in four places, and by ligaments in ten, or in other words we have dislocation opposed at fourteen points.

Vertical movement.

The middle one of three vertebræ is prevented from moving in a vertical direction to any great extent by the following surfaces. Anteriorly we have the zygosphene in its firm zygantrum, and also the prezygapophyses lying beneath the postzygapophyses of

the preceding vertebra. Lastly, we have the ball and socket joint of the centrum. Thus we have five bony surfaces opposing vertical movements anteriorly. On the other hand we have only three opposing its movement downwards. To compensate for this, we have the mechanical advantage of the ball and socket joint alluded to in describing the centrum. Posteriorly we have five surfaces opposing movement downwards, and three upwards. The reason for this appears to rest in the fact that the spinalis dorsi, semispinalis, and multifidus all run from behind forward, and consequently when these muscles act they tend to pull the vertebræ upwards and backwards, or in other words to cause them to rotate round an axis placed at right angles to the long axis of the body; consequently the anterior portion of each vertebra will be raised and the posterior will then endeavour to rotate, and thus we have the five bony surfaces of each end of the vertebra to resist the contractions of these muscles.

Classification.

As regards the classification of *Acanthophis* we have come to the conclusion that its correct position is among the *Elapidæ*. In external appearance it bears a strong resemblance to a viperine snake, and even the osseous elements of its skull tend to approach the *Solenoglyphians*. But when we examine the maxillary bone we are no longer in doubt as to its real position. This bone has undoubtedly the characters of the maxilla of the *Proteroglyphians*. There are a number of anterior grooved fangs succeeded by a number of small solid teeth. The size of the fangs is greater than that usually found in the *Elapidæ*, but this only corresponds to the great strength of the bones composing the cranium; while the venom gland also appears to be larger, both absolutely and in proportion, than is usual in the *Elapidæ*.

It would seem as if we had here a case of mimicry; one of the *Elapidæ* taking on the external form of a viper, and with this undergoing some slight internal modifications, but still remaining undoubtedly among the *Proteroglyphians*. Or we may have in *Acanthophis* a link between the venomous colubrine snakes and the vipers.

LITERATURE.

(1) E. D'Alton. De Pythonis et Boarum ossibus. Halis, 1836.

(2) ——— Beschreibung des Muskelsystems eines *Python bivittatus.* Joh. Müller's Archiv, 1834, p. 346,

(3) G. Cuvier. Leçons d'anatomie comparée; recueillies et publiés par M. Dumeril. Second edition, 1837.

(4) Dugès. Recherches anatomiques et physiologiques sur la déglutition dans les Reptiles. Annales des Sciences Naturelles, T. XII. 1827.

(5) Duvernoy. Mémoire sur les caractères tirés de l'Anatomie pour distinguer les Serpens venimeux des Serpens non venimeux. Annales des Sc. Nat. T. XXVI.

(6) Emery. Intorno alle glandole del capo di alcuni Serpenti proteroglifi. Ann. Mus. Genov. Vol. XV.

(7) Ferdinand. Zur Anatomie der Zunge. München, 1884.

(8) Flower. Osteology of the Mammalia.

(9) Gegenbaur. Grundzüge der vergleichenden Anatomie, 1870.

(10) Hallmann. Die vergleichende Osteologie des Schläfenbeins. 1837.

(11) Hoffmann. Bronn's Klassen und Ordnungen des Thier-Reichs, VI. Bd. III. Abth. 1885.

(12) Home. Observations to show that the progressive motion of snakes is partly performed by means of the ribs. Phil. Trans. 1812.

(13) Hübner. De organis motoriis Boæ caninæ. Berolini, 1815.

(14) Humphry. (1) On Muscles of *Cryptobranchus,* (2) *Lepidosiren,* (3) Smooth Dog-fish, (4) *Ceratodus,* (5) Glass-snake, (6) On the Disposition of Muscles in Vertebrate Animals. Journal of Anatomy and Physiology, Vol. VI. 1872.

(15) Huxley. The Anatomy of Vertebrate Animals, 1871.

(16) Leydig. Ueber die Kopfdrusen einheimischer Ophidier. Max Schultze's Arch. für Mikros. Anatomie, Band IX. 1873.

(17A) Jones. Todd's Cyclopædia of Anatomy and Physiology. Vol. IV.

(17) Meckel. System der vergleichenden Anatomie. 1828.

(18) Mitchell. Researches on the Venom of the Rattlesnake. Smithson. Contrib. to Knowledge. Washington, 1861.

(19) Owen. On Anatomy of the Vertebrates. Vol. I. 1866.

(20) Parker. On the Structure and Development of the Skull in the Common Snake. Phil. Trans. of Royal Society, Vol. 169.

(21) ——— On the Structure and Development of the Skull in the Lacertilia. Phil. Trans. 1879.

(22) Parker and Bettany. The Morphology of the Skull. 1877.

(23) Rathke. Entwickelungsgeschichte der Natter. Königsb. 1839.

(24) Rochebrune. Mémoire sur les vertèbres des Ophidiens. Journal de l'Anatomie et de la Physiologie par Robin et Pouchet. 17 Année. 1881.

(25) Sanders. Myology of *Platydactylus japonicus*. P.Z.S. 1870, p. 413; *ibid*, 1872, p. 154.

(26) St. George Mivart. Myology of *Menopoma Alleghaniense*. P.Z.S. 1869.

(27) Teutleben. Ueber Kaumuskeln und Kaumechanismus bei den Wirbelthieren. Archiv für Naturgeschichte. Bd. 40, s. 78, 1874.

(28) Wiedersheim. Lehrbuch der vergleichenden Anatomie der Wirbelthiere. 1882.

EXPLANATION OF PLATES.

References to Bones.

A.—Articulare. *B.S.*—Basisphenoideum. *B.O.*—Basioccipitale. *D.*—Dentale. *Ex.O.*—Exoccipitale. *E.O.*—Epioticum. *F.*—Frontale. *Fg.*—Fang. *H.*—Hyoideum. *L.P.*—Lateral plate of parietal. *M.*—Maxillare. *N.*—Nasale. *O.O.*—Opisthoticum. *P.*—Parietale. *P.F.*—Postfrontale (Postorbitale). *Pl.*—Palatinum. *P.M.*—Præmaxillare. *Pr.O.*—Prooticum. *Pr.F.*—Præfrontale (anteorbitale). *P.S.*—Parasphenoideum. *Pt.*—Pterygoideum. *Q.*—Quadratum. *S.*—Squamosum. *S.M.*—Septomaxillare. *S.O.*—Supraoccipitale. *S.T.*—Sella turcica. *T.C.*—Trabeculæ cranii. *Tr.*—Transversale (transpalatinum).

References to Muscles.

A.T.—Temporalis anterior. *C.C.M.*—Costo-mandibularis. *C.M.*—Cerato-mandibularis. *D.*—Digastricus. *D.C.*—Depressores costarum. *D.M.*—Depressor mandibulæ. *Ex.O.*—Externus obliquus. *Ex. I.*—Externi intercostales. *Ex.I.'*—Externi intercostales (straight bundles). *G.H.*—Genio-hyoideus. *G.H.G.*—Genio-hyo-glossus. *G.T.*—Genio-trachealis. *I.M.*—Intermandibularis. *I.O.*—Internus obliquus. *I.O.T.*—Tendon of internus obliquus. *I.P.*—Internus pterygoideus. *L.C.I.*—Levatores costarum interni. *L.D.*—Longissimus dorsi. *L.D.'*—Longissimus dorsi (deeper portion). *L.G.*—Lingual gland, (compressor band). *M.*—Masseter. *M.H*—Mylohyoideus. *M.S.*—Multifidus spinæ. *P.C.S.*—Pretrahentes costarum superiores. *P.C.I.*—Pretrahentes costarum inferiores. *P.M.*—Parieto-maxillaris. *P.Pt.*—Parieto-pterygoideus. *P.P.*—Parieto-palatinus, *P.T.*—Post-temporalis. *P.Ex.*—Pterygoideus externus. *R.C.*—Retractores costarum. *R.C.A.*—Rectus capitis anticus. *R.M.*—Rectus. *R.O.*—Retractor oris. *R.Q.*—Retractor quadrati. *S.D.*—Spinalis dorsi. *S.S.D.*—Semispinalis dorsi. *S.L.*—Sacro-lumbalis. *S.P.*—Spheno-pterygoideus *S.O.A.*—Suboccipito-articular. *S.R.*—Subvertebral rectus. *S.V.*—Spheno vomerine. *S.*—Scalenus. *Tr.*—Transversalis (inner bundles). *Tr.'*—Transversalis (outer bundles). *T.T.*—Transversalis (tendon).

Fig. 1.—The parietal bone. The superior surface is represented with its three areas. The middle triangular one being subcutaneous, the lateral ones giving attachment to the masseter and temporal muscles. *(X)* is the anterior extremity, which articulates with the frontal bones. *(A.L.)* antero-lateral edge, articulates with postorbital bone. *(M.L.)* the median lateral. *(P.L.)* the postero-lateral. *(Py.)* is the well marked process which gives attachment to the parieto-maxillary muscle. *(L.P.)* lateral plate of the parietal. *(P)* the posterior extremity which articulates with the supraoccipital.

Fig. 2.—The parietal bone. The inferior surface is represented together with the lateral plate. *(L.P.)* the lateral plate is seen to have an anterior depression, which is portion of the orbital fossa; while there is also a posterior depression, which gives attachment to the parieto-pterygoid and parieto-palatine muscles. *(O.S.)* is the position of the orbitosphenoid bone, helping to form the anterior portion of the orbital fossa. Between the lateral plates below, the basi- and parasphenoid bones fit; while the prootic joins its postero-lateral margin. *(O.F.)* is portion of the optic foramen.

Fig. 3.—The frontal bone with the vertical septum of bone *(V.S.)*

Fig. 4.—Postorbital bone, showing its twisted nature. To the inferior portion of this bone the fascia of the venom gland is attached as a special ligament.

Fig. 5.—The basisphenoid *(B.S.)* and parasphenoid bones united. The inferior surfaces are displayed showing the excavated parasphenoid, with a trabecula cranii on either side *(T.C.)*. Posteriorly the prominent keel of the basisphenoid is seen, while on either side of this the bone is excavated to give attachment to the spheno-pterygoid muscle. *(Px.)* is the process which articulates with the inferior surface of the basioccipital.

Fig. 6.—The superior surface of the para- and basisphenoid bones. *(S.T.)* the sella turcica.

Fig. 7—The basioccipital bone; the inferior surface. The anterior portion has an excavated area which articulates with the basisphenoid. Four prominent spinous processes are seen, which give attachment to the rectus capitis anticus, and the tendon of the sacro-lumbalis *(S.L.)*

Fig. 8.—The bones of the upper jaw; external surfaces. *(M.)* The maxilla carrying three perforated fangs in front, and three solid teeth behind. *(Tr.)* the transpalatine with the well marked process *(P.C.)*, which gives attachment to the internal pterygoid muscle. *(Pl.)* the palatine carrying solid teeth. *(Pt.)* the pterygoid with solid teeth.

Fig. 9.—Superior surfaces of same bones. The concavo-convex joint between the maxilla and transpalatine is seen; also the excavated internal edge of the maxilla. The surface of the pterygoid is seen which gives attachment to the parieto-pterygoid and spheno-pterygoid muscles.

Fig. 10.—Inferior surface of the same bones; the excavated surface of the pterygoid is seen which gives attachment to the internal pterygoid muscle.

Fig. 11.—The prefrontal *(Pr.F.)* is seen, and on its superior edge is a well marked hinge-joint *(H.J.)*, which articulates with the frontal. The articulating surfaces between the prefrontal and the maxilla are seen to differ from that present in most venomous snakes.

Fig. 12.—The skull viewed from above. On the right side the postfrontal and the prefrontal have both been removed.

Fig. 13.—Muscles of the head from above. On the left side the masseter has been drawn aside, and the attachment of its superficial fibres to the posterior portion of the venom gland (*V.G.*) is shown. (*M.'*) is the deeper portion of the masseter, which chiefly goes to the lower jaw. The anterior temporal (*A.T.*) is displayed. (*Z.L.*) is the zygomatic ligament attached to the venom gland. (*Pt.*) are the fibres of the platysma spreading out to be lost anteriorly. The retractor quadrati is seen passing back beneath the retractor oris, but above the depressor mandibulæ. On the left side the spinalis dorsi has been removed, and the semispinalis is seen attached to the skull.

Fig. 14.—The muscles of the head are seen from the side. The retractor oris (*R.O.*) is reflected, and the depressor mandibulæ is pulled aside. The attachment of the superficial portion of the masseter to the gland is seen, while the attachment of the masseter, posterior temporal, and internal pterygoid to the lower jaw is also seen. (*S.L.G.*) the superior labial gland. (*I.L.G.*) the inferior labial. (*V.D.*) the venom duct.

Fig. 15.—The masseter has been removed from the venom gland, and the parieto-mandibular (*P.M.*) is displayed, as also is the anterior temporal (*A.T.*); the lachrymal gland (*L.G.*) is seen. (*V.D.*) venom duct.

Fig. 16.—The venom gland has been removed. The slender parieto-maxillary is seen, and the attachment of the anterior temporal to the lower jaw. The posterior temporal has been reflected, and the external pterygoid displayed. The parieto-pterygoid (*P.Pt.*) is also seen, and the insertion of the internal pterygoid on the transverse bone.

Fig. 17.—The temporal muscles have been removed, and the whole of the lower jaw. The parieto-mandibular is seen springing from the prominent process of the parietal. The parieto-pterygoid (*P.Pt.*) and spheno-pterygoid are seen attached to the pterygoid bone. 5″, 5‴ branches of the fifth nerve emerging from the foramen ovale. (*Q.B.*) portion of the quadrate bone.

Fig. 18.—The parieto-pterygoid and spheno-pterygoid muscles have been removed, and the parieto-palatine displayed. (*S.O.A.*) the sub-occipito-articular (Dugès). (*L.D.*) longissimus dorsi attached to skull. (*S.L.*) sacro-lumbalis attached to basioccipital. (*R.C.A.*) rectus capitis anticus attached to basioccipital and exoccipital bones.

Fig. 19.—Inferior surface of the head. On the right side of figure the mylohyoid has been removed, and the membrane lining the floor of the mouth is shown. (*T.C.*) trachea. Anteriorly portion of the intermandibularis is removed; the lingual gland (*L.G.*) with its band of muscle is seen. The attachments of the genio-hyoglossus and genio-trachealis are also seen. The genio-hyoglossus is shown to have a bifurcated attachment; one tendon being attached to the tendon of the intermandibularis in the midline; while the other is inserted into the inner side of the dentary. The attachment of the cerato-mandibularis has been cut; it runs forward and joins the tendon of the intermandibularis; posteriorly it lies along the lower jaw. The mylohyoid (*M.H.*) is seen to be attached to the bony hyoid (*H.*) internally, while anteriorly it is attached to the lower jaw. (*T.I.—T.I′.*) are the tendinous intersections which represent ceratohyal and hypohyal (*T1.*), and the first branchial bar (*T″*). The portion (*H.*) represents the hypobranchial portion of the hyoid. (*G.H.*) are the genio-hyoid muscles arising posteriorly from the hyoid bars. (*J.H.*) the junction of the hyoid bars (basihyal plate).

Fig. 20.—The intermandibularis (*I.M.*) is shown giving off (*IM'.*) a slip to the integument (*C.M.*); the cerato-mandibularis joins the intermandibularis in front. (*I.L.G.*) inferior labial gland.

Fig. 21.—The costo-mandibular (*C.C.M.*) is seen running forward to join the depressor mandibulæ (*D.M.*) to form the mylohyoid (*M.H.*). On the left side of the figure the mylohyoid has been removed, and we see the masseter (*M.*), posterior temporal (*P.T.*), and internal pterygoid (*I.P.*). The external intercostals are seen, and the scalene muscles, while the rectus capitis anticus (*R.C.A.*) lies still more deeply.

Fig. 22.—The lower jaw has been removed. On the left side we have the internal pterygoid reflected, and the parieto-pterygoid and spheno-pterygoid displayed. On the right side of the figure we have the internal pterygoid, and the aponeurosis of the roof of the mouth (*P.A.*). Anteriorly we see the small spheno-vomerine muscle (*S.V.*).

Fig. 23.—The muscles composing the greater portion of the erector spinæ. The spinalis dorsi is seen to lie next the spinous processes (*S.*) and to break up into tendons which run forward to be inserted in the spines (*S.*). The tendons of these muscles are intimately connected and form a distinct aponeurosis. (*L.D.*) the longissimus dorsi group; the superior layer is seen to give off tendons which run outwards and form the tendons of origin of the sacro-lumbalis group. The inferior tendons run inwards and join with the tendons of the spinalis dorsi group.

Fig. 24.—(*S.L.*) the sacro-lumbalis column, arising in part from the longissimus dorsi column, and inserted along with the tendons of the pretrahentes costarum superiores (*P.C.S.*). Between the tendons of the latter muscles are the tendons of the external oblique (*Ex.O.*).

Fig. 25.—The muscles on the lateral aspect of the snake's body. The tendons of the sacro-lumbalis (*S.L.*) are seen to be inserted into the ribs along with the tendons of the pretrahentes costarum superiores (*P.C.S.*). The external oblique (*Ex.O.*) is seen to be composed of bundles intimately connected with the rectus (*R.M.*). The internal oblique springs from the costal cartilages as "leaves" of muscles, and running forward these are attached to the spaces between the scutal muscles (*S.M.*). A tendinous band (*I.O.T.*) continues the muscle towards the midline where it joins the tendon of the transversalis (*T.T.*). The fibres (*Ex.I'.*) are modified external intercostal muscles.

Fig. 26.—The muscles in the interior of the snake's body. By the mid-line we have the subvertebral rectus (*S.R.*) and the depressores costarum (*D.C.*). On the left side of the figure levatores costarum interni (*L.C.I.*), separated from the subvertebral rectus by the intercostal nerves (*I.N.*).

Fig. 27.—The depressores costarum (*D.C.*) are seen running forward to be modified so as to form a rectus capitis anticus major (*R.C.A.*), and at the same time representing the longus colli muscles. The most anterior bundle of the sacro-lumbalis column (*S.L.*) is seen to pass forward to be inserted on the basioccipital (*B.O.*), while the upper division of the rectus capitis anticus runs outwards and is inserted on the exoccipital. The scalene (*S.*) muscles are represented by the continuation of the external intercostal group on to the anterior vertebræ.

NOTES ON AUSTRALIAN EARTHWORMS. Part VI.

By J. J. Fletcher, M.A., B.Sc.

In the following paper eight species chiefly from Eastern Australia are proposed as new, an attempt is made to deal with a number of small perichæte worms from various localities, which are treated as varieties of species previously described, and further particulars are given about four species as the result of the examination of additional and better supplies of material than were originally available. As in previous papers the question of the genera to which some of the species described should be referred is left an open one; some of the most favourable localities even in this colony are yet unsearched for earthworms, and the question of instituting new genera is one therefore which may more profitably be considered later on.

The new forms include, firstly, five described as species of *Cryptodrilus*—one of the type of *C. unicus*, one with a remarkable arrangement of the outer couples of setæ the outer row of each of which is nearer to the mid-dorsal line than the inner row of each inner couple is to the mid-ventral line, one very robust form of the type of *C. mediterreus* and *C. canaliculatus*, and two others whose affinities at present are not very clear: secondly, a species of *Acanthodrilus* from N.W. Australia, the second species only of this genus so far recorded from Australia, in each case from the northern half of the continent: and thirdly two species of *Perichæta*, one of the type of *P. austrina*; the other a remarkable, probably intraclitellian form of the type of *P. canaliculata*, with a pair of conspicuous nephridiopores to a segment after the first, those of each side of the body forming a sinuous series.

I have to express my great obligations to Sir William Macleay, and to the Trustees of the South Australian Museum for the opportunity of describing several species, and to the following gentlemen for furnishing me, often at considerable trouble, with supplies of material, viz. Messrs. W. W. Smith, C. E. Rennie, Henry Tryon, T. G. Sloane, and the Revs. A. Swift, and T. F. Potts.

CRYPTODRILUS (?) FASCIATUS, n.sp.

Two (spirit) specimens 15-15·5 cm. long, 6-9 mm. broad; number of segments 90 and 130.

Colour: an anterior and a posterior portion of each segment of a light colour (dull yellowish in the specimens which have been some years in spirit and are in places somewhat stained or bleached), enclosing a wider middle dark purplish or purple band, reminding one of *Allolobophora fœtida*; sometimes the purple band is broader than at others, especially at first, but on the whole the body in both specimens presents a very noticeable and characteristic banded appearance, alternately light and dark, obscured by the girdle on the clitellar segments.

Prostomium divides the buccal ring very slightly (less than ⅓). Body apparently not so depressed (at any rate in spirit specimens) as in *C. unicus*; one specimen is faintly but distinctly canaliculate throughout in the median dorsal line, the other only shows it here and there. Segments more or less distinctly bi-annulate (in one specimen a layer of the body-wall is caking off which is 4-annulate on the surface, whereas underneath the surface is bi-annulate).

Setæ in eight straight rows, the setæ of the outer couples further apart than those of the inner couples, and about as far apart as (usually a trifle further than) the two couples of each side.

Clitellum in one specimen comprising six segments, XIII-XVIII, complete all round; in the other less developed, but segments XIV-XVIII together with the posterior half of XIII are noticeably modified

Male pore, oviduct pores (in front and just ventrad of the innermost setæ), spermathecal pores, dorsal pores, and nephridiopores as in *C. unicus.*

Alimentary canal: the œsophagus longer, and the gizzard further back, than usual, the former extending through v, vi and into vii, the latter at first sight appearing to be contained in segments vii and viii, the mesentery between these two surrounding it at about its middle, but investing it posteriorly; from x or xi to at least xiv (behind which in the specimen dissected the canal was damaged) the interseptal portions are dilated possibly functioning as calciferous glands, and in xiii and xiv there are incompletely pinched-off pouches.

Genitalia: two pairs of testes and ciliated rosettes in x and xi; vesiculæ seminales five pairs in ix-xiii, the first two pairs small, the last pair still smaller and rudimentary, the third and fourth pairs very large; a single vas deferens on each side joining the prostatic ducts a little way from the prostates. Spermathecæ a median series of five single stalked, rather long pouches, sacculated in appearance, in segments v-ix, each of them with two linear, long (but shorter than the pouches) almost cylindrical cæca, one on each side.

Last pair of hearts in xii.

Nephridia: a pair of tubules to a segment after the first, consisting as well as I can make out of at least three portions, viz., a distal convoluted portion whose free extremity lies in the segment in front of that to which the nephridium belongs, a shorter narrower middle portion, and a proximal still shorter vesicular or dilated portion with a lateral diverticulum.

Hab.—Richmond River District, N.S.W. *(Macleay Museum).*

This distinct species differs from both *C. unicus*, and *C. purpureus* in having the body more robust and transversely striped, and from the latter in addition in the rows of setæ being straight. These three species form a group of closely allied forms whose claims to

be regarded as worthy of generic separation will be considered hereafter. I have a single specimen in very bad condition of what is probably another species of this group from the same district, given me by Mr. H. R. Whittell.

Cryptodrilus (?) purpureus.

Cryptodrilus purpureus, Michaelsen, "Oligochæten des Hamburger naturhistorischen Museums," I.

Three spirit specimens from two different localities, 47 (juv.), 93, and 92 mm. long, 3-6·5 mm. broad; number of segments 116, 131, and 144.

Colour purplish above, paler below. Prostomium only partially divides the buccal ring (less than half). Segments for the most part bi-annulate, occasionally indistinctly tri-annulate. Setæ in eight at first straight longitudinal rows, those of the outer couples more than twice as far apart as those of the inner couples, and a little further than the two couples of each side; in about the posterior third of the body, or on about the last 40-50 segments the setæ of the two rows of the outer couple of each side are irregularly placed, sometimes alternating pretty regularly for a few segments, sometimes two or three times as far apart from each other, or from the inner couple, as at others.

Clitellum not developed, nor any indication of it in any of the specimens.

Male pore, oviduct pores, and spermathecal pores as in *C. unicus*. Dorsal pores commence after segment IV, but the first one appears to be rudimentary and not functional. Nephridiopores: the first three dorsad of, the others opposite, the fourth setæ on each side as long as these continue regular, afterwards continuing at the same level irrespective of the setæ.

Alimentary canal as in *C. unicus*.

Genitalia as in *C. fasciatus* and *C. unicus*.

Nephrida possibly as in *C. fasciatus*, but the details not made out.

Hab.—Miriam Vale, Queensland (two specimens presented by Dr. J. C. Cox to the Macleay Museum); Percy Island off the Queensland coast in lat. 21° S. (one specimen also in the Macleay Museum, collected by Mr. G. Masters during the 'Chevert' expedition in 1875).

The characters of the three specimens examined agree very well with Dr. Michaelsen's description based on the examination of specimens from Gayndah and Peak Downs, Queensland, but have the setæ slightly more irregular. Michaelsen says that the third and fourth rows are displaced on the last ten segments of the body, whereas in the specimens examined by me the irregularity affects more segments, about the last forty; also the first three pairs of nephridiopores are more dorsally situated than those which follow. The specimen from Percy Island is referred to in my second paper p. 971 under the head of "*incertæ sedis*;" owing to its immature and contracted condition its examination was not attended with very satisfactory results.

Cryptodrilus (?) unicus.

Cryptodrilus unicus, Fl., P.L.S. N.S.W., 1888, III., (2), p. 1540.

Three additional specimens from a new locality; 63 (juv.) to 100 mm. long, 3-6 mm. broad; number of segments 126-144.

Clitellum in two of the specimens comprising segments XIV-XVII together with at least half of XIII and of XVIII. From the examination of these specimens, two of which are better developed than any seen before, and from a re-examination of the original specimens, my previous description may be amended as follows:—

The rows of setæ are straight and regular throughout.

The oviduct pores are in front and just ventrad (not dorsad) of the innermost setæ on XIV.

The gizzard is in segment VI.

There is a fifth pair of vesiculæ seminales on the posterior face of the mesentery between XII and XIII; the fifth pair, always the smallest, are so small in non-breeding worms as to be easily overlooked.

The spermathecæ are single median pouches, each with two cæca, as in *C. fasciatus*, and *C. purpureus*; not pairs of pouches one of each of which is rudimentary.

Hab.—The banks of Lake Cudgellico, a few miles from the Lachlan River, N.S.W. (collected by Mr. T. G. Sloane).

Cryptodrilus Smithi, n.sp.

A good series of about eighty specimens killed in an extended condition from 21 (juv.) to 145 mm. long, 1-3 mm. broad; number of segments from about 135-170.

Prostomium divides the buccal ring all but completely. Body slender, cylindrical, segments mostly tri-annulate; colour pallid, the integument more or less pellucid.

Setæ in four ventral and four dorsal longitudinal rows forming on each side of the body a ventral and a dorsal couple separated by an ususually wide interval: the setæ of the ventral couples distant from each other about as far as (or a trifle less than) their inner rows are from the median ventral line; those of the dorsal couples at varying distances apart, the third row on each side not being straight, rarely closer but usually more distant than those of the ventral couples; except on the first three or four setigerous segments (II-IV or V) where they are a little further removed, the setæ of each fourth row quite close (unusually so) to the median dorsal line, closer than the first (ventral) row is to the median ventral line.

Clitellum of four segments, XIV-XVII, complete all round except for certain papillæ. On the ventral surface between each two segments from XV-XX, but encroaching more or less upon these, is a pair of contiguous nearly circular or elliptical eminences or papillæ, one on either side of the median line, their summits with a pore-like depression; those of the third and fourth pairs (between XVII and XVIII, and XVIII and XIX) much depressed, and less conspicuous, and with an additional very conspicuous papilla immediately dorsad of each of them—the posterior pair of which probably carry

the male pores which are not readily determinable; the papillæ of the fifth and of the sixth pairs not quite so close to the median line; the ventral surface about the bases of the papillæ usually more or less tumid, sometimes forming distinct transverse ridges on which the papillæ are situated. The youngest specimens show no trace of these structures; others show papillæ without any or with only slight modification of the surrounding surface; others again show pore-like depressions or these with the margins only slightly tumid forming rudimentary papillæ, situated on distinct transverse more or less intersegmental ridges* formed by the ventral surface of the posterior one or two annuli of each segment becoming tumid for a space extending dorsad on each side to as far as or beyond the second setæ, and more or less completely confluent with a similarly modified portion of the anterior one or two annuli of the succeeding segment, or only one of the two sets may be modified; the first and second ridges shortest (from side to side), the third and fourth longest (from side to side), most pronounced, and closer together; in this region what appear to be the intersegmental, are only interannular furrows. In adults with girdles the papillæ are well-developed, and the ridges usually less distinct, the remnants of them appearing as swellings about the bases of the papillæ, except in case of the first two pairs which are entirely surrounded by the girdle tissue. In examining a number of specimens differences in detail are common; rarely an additional pair, or only a single papilla, may be present between XIV and XV. Between VIII and IX, and IX and X a pair of similar papillæ with sometimes in addition a ventral portion of the preceding one or two annuli modified; the anterior pair probably carry the fourth pair of spermathecal pores. Occasionally the ventral surface behind the papillæ is also slightly modified; and in one case there is an additional papilla on one side between X and XI.

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*Possibly after all better regarded as primarily due to the coalescence and extension of the papillæ, as the ridges always show some indication of papillæ, whereas papillæ without ridges are not uncommon.

Male pores not readily determinable. Oviduct pores two, on XIV on little papillæ, in front and a little ventrad of the first setæ; spermathecal pores four pairs, intersegmental from V-IX, on little papillæ (the fourth pair of these modified as above) about opposite or slightly ventrad of the first setæ.

Dorsal pores commence after segment IV. Nephridiopores not visible (probably a pair on each segment except a few anterior ones).

Alimentary canal: gizzard in V (or VI); in some of segments IX-XVI there are dilatations some of which may be calciferous glands, but there are no pairs of pouches; large intestine commences about XVIII but is small and compressed between the prostates as far back as XXII.

Genitalia: two pairs of vesiculæ in IX and XII; two pairs of testes and ciliated rosettes in X and XI; a pair of prostates extending through about four segments, XVIII-XXI; genital ducts rather long and twisted; vasa deferentia not observed. Penial setæ absent. Ovaries and oviducts as usual; spermathecæ four pairs in VI-IX, stalked pouches with a single rudimentary club-shaped cæcum on the duct near its exit, the cæcum shorter than the duct.

Nephrida: a pair of convoluted tubules to a segment.

Last pair of hearts in XII.

Hab.—Eltham, Victoria (collected by Mr. W. W. Smith).

This distinct species is easily recognisable by the remarkably dorsal situation of the outer couple of setæ on each side, an exaggerated condition of the arrangement which is so frequently met with in species of this genus. Its affinities are not very clear.

CRYPTODRILUS TRYONI, n.sp.

One (very soft and not well preserved) specimen 325 mm. long, 10 mm. broad; number of segments about 209.

Buccal ring not divided by the prostomium. Colour (much bleached) more or less pallid, slightly tinged with brown superiorly. Body not canaliculate.

Setæ in eight straight rows, those of each outer couple remarkably far apart, not only further apart than those of each inner couple, but also (half as far again or even more) than the two couples of each side.

Clitellum of four segments, XIV-XVII, together with a small anterior portion of XVIII (but has not attained its maximum development), complete all round except posteriorly for a little space on the ventral surface of XVII.

Male pores not at all conspicuous (probably only owing to the condition of the specimen); the inner couples of setæ on XVIII are not visible, but about corresponding with the position of each inner setæ of these couples is a small pore, from one of which protrudes a portion of what is evidently a penial seta; possibly these are the male pores. Oviduct pores and spermathecal pores as in *C. mediterreus.*

Nephridiopores: a pair to a segment after the first, in two alternating series as in *C. mediterreus*; the first four pairs, and after these on alternate segments, opposite the fourth setæ; on segments VI, VIII and X opposite the third setæ, and on XII and after that on alternate segments opposite the second setæ. Dorsal pores commence after segment V. Accessory copulatory structures not present.

Alimentary canal: gizzard in V; five pairs of latero-inferiorly situated calciferous pouches in IX-XIII.

Genitalia: two pairs of vesiculæ seminales in IX and XII, &c. as in *C. canaliculatus*; there is a single vas deferens on each side joining the genital duct close to the prostates; penial setæ are present. Spermathecæ three pairs, each of them with two cæca.

Last pair of hearts in XIII.

Eight mesenteries from the anterior one of VII to the posterior one of XIII are thick.

The nephrida of the lower rows (opening opposite the second setæ) as well as those of the upper rows have a proximal vesicular

portion, a condition which possibly obtains also in the other species of this group.

In other respects so far as I know at present not differing from *C. mediterreus.*

Hab.—Milton, near Brisbane, Queensland (received from Mr. Henry Tryon).

This species is allied to *C. mediterreus* and *C. canaliculatus*: with the former it agrees in having the body not canaliculate; and with the latter in having two cæca to each spermatheca; while it differs from both in having the body more robust (being the largest specimen of a *Cryptodrilus* I have yet seen, with the exception of *C. saccarius*, var., to be mentioned subsequently), the setæ of the outer couples further apart, and an additional pair of calciferous pouches in IX. In the soft condition of the specimen examined the sacs containing the penial setæ are not visible, as was the case with the specimens of *C. canaliculatus* previously examined, in which species also, as I have since found, penial setæ are present.

CRYPTODRILUS SEMICINCTUS, n.sp.

Four moderately contracted spirit specimens 40-54 mm. long, 2·5-3 mm. broad; number of segments about 100.

Prostomium partially divides the buccal ring (about half). Body probably pallid or slightly tinged with brown or yellowish brown, slender, segments mostly tri-annulate.

Setæ of the outer couples a little further apart than those of the inner couples which are not so close as usual, and nearly as far apart as the two couples of each side; the outermost row on each side not so dorsally situated as usual.

Clitellum of segments XIV-XVII together with half or two-thirds of XIII, saddle-shaped, reaching only to about the third row of setæ or a little ventrad of it, not developed on the ventral surface.

Male pores two, on papillæ on the middle annulus of XVIII, about in line with the setæ of the second row; in front and also behind but a little dorsad of each papilla is a much smaller one,

usually intersegmental taking in one annulus of XVIII and one of the segment in front or behind, or confined only to the annuli of XVIII. Oviduct pores two, rather close together, in front and ventrad of the innermost setæ on XIV. Spermathecal pores two pairs between VII and VIII, and VIII and IX, in line with or just dorsad of the setæ of the second row.

Nephridiopores not visible in any of the specimens. Dorsal pores not determinable on the clitellum nor in front of it, the first visible one between XVIII and XIX.

Alimentary canal: gizzard in V; calciferous dilatations possibly in about segments IX-XIII, but no pairs of pouches; the large intestine begins in XVI.

Genitalia: one pair of testes and one pair of ciliated rosettes in XI; one pair of vesiculæ seminales in XII; a pair of long narrow linear folded prostates partly in XVIII and partly in XIX, anteriorly giving off the genital ducts which are fairly long and straight, a single vas deferens on each side joining the prostatic duct close to the gland; behind each genital duct is a pair of delicate sacs each containing a couple of curved tapering penial setæ. Ovaries and oviducts as usual; spermathecæ two pairs in VIII and IX, pouches with remarkably long ducts each with a pair of (in one case three) simple club-shaped cæca, one on either side of the duct near its exit.

Nephridia: delicate tubules, a pair to a segment.

Last pair of hearts in XII.

Hab.—Grafton, Clarence River, N.S.W. (received from the Rev. A. Swift).

A distinct species whose affinities are not very clear at present. I received a considerable number of worms from Mr. Swift, but with the exception of the above and half a dozen specimens of perichæte worms, the rest were simply the ubiquitous *Allolobophora turgida*, for which Grafton is the most northerly locality in N.S.W. from which I have yet seen specimens.

Cryptodrilus simulans, n.sp.

Three rather contracted spirit specimens from 82-108 mm. long, 4-5 mm. broad; number of segments about 220.

Colour when fresh probably pallid with the integument more or less pellucid behind the girdle (spirit specimens usually tinged with brown). Prostomium only partially divides the buccal ring (less than half). Segments mostly tri-annulate after the first three or four.

Setæ of the inner couples closer together than usual, about half as far apart as those of the outer couples, the latter also about half as far apart as the two couples of each side; hence the outer couples or at least the outer rows of these are more laterally situated than in many species.

Clitellum: no sign of it in two specimens, just commencing in the third; when complete probably comprising xiv-xvii and part of xiii.

Male pores on two small papillæ, a little dorsad of the position of the first seta on each side, on the middle annulus of xviii which presents a ridge-like swelling separated from somewhat similar but less pronounced ridges on xvii and on xix by a depression in each case, the ends of the first and last ridges bending round and fusing with the middle one, their extremities reaching a little dorsad of the first couples of setæ; on the anterior annulus of xviii and of xix appears to be in each case a pair of pores. Oviduct pores two, in front and ventrad of the innermost setæ; spermathecal pores two pairs between vii and viii, and viii and ix, nearly opposite but a little dosad of the first setæ.

Nephridiopores not visible. Dorsal pores commence after about x but the first one appears to be rudimentary.

Alimentary canal: gizzard in v, the mesentery behind it very thin; only two pairs of calciferous pouches seem to be present, in xiv and xv, but these in the specimen dissected immediately attracted notice, and in one specimen are discernible from the exterior; large intestine commences in xvii.

Genitalia: two pairs of testes and of ciliated rosettes in x and xi; two pairs of racemose vesiculæ seminales in xi and xii; the prostates extend through about three segments; beside each straight genital duct is a pair of small sacs each containing several (3 or 4) curved and gradually tapering but not spinose penial setæ. Ovaries and oviducts as usual; spermathecæ two pairs in viii and ix, their ducts remarkably long, each with a lobate somewhat compressed and rosette-like cæcum.

Last pair of hearts in xii. Nephridial tufts numerous.

Hab.—Bulli, Illawarra, N.S.W. (received from Rev. T. F. Potts and Mr. T. G. Sloane).

Externally and in the absence of the clitellum this distinct species might pass for a species of *Digaster* or *Megascolides*; like the preceding species its affinities are not very clear.

ACANTHODRILUS MACLEAYI, n.sp.

About 110 small specimens, one of the largest of which is 27 mm. long, 2 mm. broad; number of segment about 90.

Colour rather light yellowish-brown. Prostomium only partially divides the buccal ring (less than half).

Setæ: four pairs to a segment after the first one, the setæ of the outer pairs close together like those of the inner ones; the inner pairs on xvii and on xix either not visible (probably then only obscured by the swellings on these segments) or situated a little dorsad of the usual position.

Clitellum present in a few specimens, comprising segments xii-xvi or xvii.

Male pores two pairs, a pair on xvii and a pair on xix, the pores of each pair rather close to, and one on either side of, the median line, distinctly closer to the median line than the innermost row of each inner pair of setæ would be if normally placed. The ventral surface of xvi and xvii, and to a less degree of the next two or three segments more or less modified and swollen as far

dorsad as the second pair of setæ, the modified surfaces more or less confluent, but intersegmentally for a short distance on either side of the median line less modified; hence the three or four intersegmental depressions (the first one between XVI and XVII) so commonly present in spirit specimens are probably *post-mortem* and due to shrinkage.

Oviduct pores, spermathecal pores, nephridiopores, and dorsal pores not determinable.

Alimentary canal: a single large gizzard present.

Genitalia: a large pair of vesiculæ seminales (probably in XII), a doubtful smaller pair situated two segments in front, with two pairs of ciliated rosettes (and probably testes) in the two intervening segments; prostates two pairs, with two pairs of straight fairly long genital ducts; four pairs of delicate sacs, a pair to each genital duct, containing penial setæ, long, curved, and tapering, and minutely notched distally, the free extremity not a sharp point, but flattened.

Nephridia: a pair of tubules to a segment.

Hab.—Napier Range, 100 miles S. of King's Sound, N.W. Australia (Macleay Museum, collected by Mr. W. Froggatt).

These were the only specimens of earthworms obtained by Mr. Froggatt during nearly a year's residence in the Kimberley District. Owing to their small size—the largest of them just exceeding an inch—it is difficult to make out the details or to localise the various organs. There is no doubt however about the presence of two pairs of prostates and two pairs of genital ducts. This species is distinct from *A. australis* from Cape York recently described by Dr. Michaelsen (*l.c.*, p. 9).

PERICHÆTA MACQUARIENSIS, n.sp.

Five well preserved somewhat contracted spirit specimens 130-180 mm. long, 5-7 mm. broad; number of segments about 150-200.

Colour purplish or reddish-brown, paler beneath. Prostomium partially divides the buccal ring (about half); sometimes from its posterior margin a median longitudinal groove extends backwards as far as the third segment.

Setæ fewer, larger and more conspicuous, the setiferous ridges also more conspicuous, in front of the clitellum; segment II (the first setigerous one) with probably normally about 18 setæ [in the specimen in which the setæ are most complete there are 9 on one side and 8 on the other; most of the specimens have 16; one shows only 6]; segments III and IV with about 26; V-XV with about 28 (in one case segment VII has 15 on one side and 14 on the other), from XIX with 32-36, the posterior segments—except the last few—with about 40-44; very frequently owing to breakages or other causes only fewer than the numbers specified can be counted on a given segment. A median dorsal interval about 2-2½ times, and a median ventral interval about thrice the width of an ordinary interval between two setæ, devoid of setæ.

Clitellum (in two specimens) comprising four segments, XIV.-XVII.

Male pores on papillæ, about corresponding with the intervals between the first and second setæ; adjacent to and dorsad of each pore is an additional slight swelling or papilla. The posterior ⅔ of the ventral surface of XVII and the anterior ⅔ of XIX modified, in each case with an indistinct pair of papillæ much as in *P. austrina*: in specimens with girdles the ventral surface of segments X and XI modified much as in *P. austrina* but the swellings are not pitted, and the posterior one is not subdivided; in one specimen on X.-XII are three pairs of swellings extending antero-posteriorly across the segment, and from side to side from about the first to the third setæ, with a little pit in front and one behind the setigerous ridge. Oviduct pores two, in front and ventrad of the innermost setæ; spermathecal pores three pairs, intersegmental after VI, nearly opposite or a little dorsad of the first setæ.

Dorsal pores commence after segment IV (sometimes apparently a rudimentary one after III). Nephridiopores not visible.

Alimentary canal: calciferous pouches in X-XIII (almost like a smaller pair in XIV).

Genitalia as in *P. austrina*, that is to say two pairs of testes and ciliated rosettes in X and XI, two pairs of vesiculæ seminales

in IX and XII &c.; but in the specimen dissected the cæca of the spermathecæ not so long (possibly only due to its non-breeding condition); and penial setæ only slightly curved but sharply bent almost at a right angle close to the free extremity are present. Last pair of hearts in XIII.

Hab.—Dubbo, N.S.W.; from the banks of the Macquarie River (collected by Mr. C. E. Rennie).

Allied to *P. austrina* and *P. hamiltoni*, but distinguished from them by the slightly more ventrally situated spermathecal pores, by details in the number of setæ, by the possession of penial setæ, and of a pair of hearts in XIII, and other details.

PERICHÆTA (?) TERRÆ-REGINÆ, n.sp.

One specimen rather contracted except in the middle region of the body which is soft and relaxed, 190 mm. long, 15-18 mm. broad; number of segments 144. Body stout, cylindrical; segments III-XIII biannulate, but with the anterior annulus in some of them faintly again subdivided; behind XIII there is little indication of annuli, nor are setiferous ridges anywhere prominent. Colour dark, probably purplish (the specimen both somewhat bleached and stained). Prostomium but slightly divides the buccal ring (about $\frac{1}{3}$).

Setæ: from their retraction, worn condition, or absence, it is difficult to determine the number of the setæ on the first few and the last few setigerous segments; elsewhere one may count from about 40-60 to a segment, with a median dorsal and ventral interval devoid of setæ of which the latter is fairly defined, its limiting rows of setæ straight, about five times the breadth of an ordinary interval between two setæ on the ventral and lateral surfaces where they are closer together, more regular, and not so frequently missing as on the dorsum; the latter much broader, ill-defined owing to the absence or irregularity of the setæ.

Clitellum not developed, but segments XIV-XXI, and XIII and XXII slightly, are of a noticeably different colour, a brighter

purplish ; from experience in other cases I regard this as indicative of a waxing or a waning clitellum. If so then this species like *P. canaliculata* is intraclitellian.

Male pores on two large papillæ, the outer (dorsal) margin of each extending to about the sixth setæ, their inner margins connected by an intermediate somewhat swollen portion ; these structures occupy the entire ventral surface of XVIII within the limits mentioned, obscuring the setæ if these are present, and they bulge a little antero-posteriorly; the pores themselves are about in the line of the second row of setæ. Oviduct pores two, in front and a little ventrad of the innermost setæ on XIV; spermathecal pores four pairs in the intervals between segments IV-VIII, about opposite or a little ventrad of the second setæ; (the first pair a segment in advance of the usual arrangement).

Dorsal pores commence after segment V. Nephridiopores a pair to a segment after the first, just behind the anterior margins, forming a single irregularly sinuous series on each side, the pores varying in position from opposite the fourth or fifth setæ to dorsad of any visible setæ, and not very far from the median dorsal line.

Hab.—Mt. Bellenden-Ker, N.E. Queensland (received from Mr. Henry Tryon).

This distinct species belongs to the same group as *P. canaliculata*, Fl., from the same district. At present I refrain from dissecting the single specimen available.

From time to time I have received or collected a number of small perichæte worms from various localities in N.S.W., which while differing for the most part a good deal in size or general appearance from the typical forms of the species to which as varieties, at any rate provisionally, I now propose to refer them, yet present no sufficiently satisfactory or important points of difference entitling any of them to rank as independent species. From the small size and stunted growth, or not good state of preservation of some of them, together with the difficulty in determining

the number of setæ on the first few setigerous segments they are not a very satisfactory lot to deal with; but for the sake of the interest attaching to the questions of variation and geographical distribution, the attempt is here made to deal with them.

The majority of them agree with *Perichæta Macleayi* described in my last paper in having (1) the preclitellar or a few more segments with 20 setæ per segment, increasing then to 24, and still further back to about 28-30; (2) the buccal ring nearly completely divided by the prostomium; (3) two pairs of spermathecal pores opposite the second or third setæ, or the interval between them; (4) both pre- and postclitellar accessary copulatory structures; (5) calciferous dilatations in some of segments IX or X-XIII, but pouches are not pinched off;* and (6) the same general characters of the genitalia, *e.g.*, two pairs of vesiculæ seminales in IX and XII, and two pairs of spermathecæ each of them with a single long club-shaped cæcum. Besides size they differ among themselves slightly in regard (1) to the number and character of the accessory copulatory structures; the situation of (2) the first dorsal pore and (3) the spermathecal pores which in some are more nearly opposite the second, in others opposite the third setæ. They are accordingly treated as three varieties, noted separately from each locality. The remainder in which the number of setæ is slightly greater, probably normally 24 setæ on the anterior setigerous segments, are similarly treated as a variety of *P. fecunda* with two pairs of spermathecæ.

P. Macleayi, Fl., [*l.c.* (2) III, (1888), p. 1556], vars. nov.

Var a:—Thirteen specimens 60-87 mm. long, 3-4 mm. broad; number of segments from about 110-125.

Setæ: the first thirteen setigerous segments (ii-XIV or thereabouts) with twenty setæ to a segment [frequently only fewer are visible, often 16 or still fewer; nevertheless as 10 may often be counted on one side of a given segment, or a seg-

* "The two pairs of calciferous pouches in XI-XII" (*l.c.*, p. 1557) are so incompletely pinched off as to be little more than dilatations.

ment with 20 may precede one with 16, or when fewer than 20 the setæ are evidently at greater intervals, it would seem that 20 per segment is the normal number; hence differences are probably quite as much to be attributed to wear and tear as to possible variation]; this number then gives place to 24 (occasionally two or three more, though in this region one may find a segment preceded and followed by one with a greater number) which continues for a number of segments; finally posteriorly except on just the last few segments the number increases to about 30 or a few more. The body tapers steadily posteriorly and here the dorsal interval devoid of setæ may be said to vanish, the interval being not greater than that between two ordinary setæ.

Clitellum comprising segments XIV-XVII, together with XIII partially.

Accessory copulatory structures comprise (1) the ventral surface of X outwards on each side to beyond the second seta tumid, more or less completely longitudinally divided in the median line, and with four fossettes, an anterior and a posterior pair; and (2) pairs of papillæ on XVI and XVII, the ventral surface of XVIII dorsad of the male pores also swollen.

Dorsal pores after V as in the typical form.

Hab.—Mt. Wilson and Lawson, Blue Mts., N.S.W.

Var. b:—Seventeen specimens 57 (juv.) to 120 mm. long, 3-4 mm. broad; number of segments about 115-140.

Setæ: on the preclitellar segments usually 20 per segment, but the following variations were noted in different specimens:—on segment V, 14 on one side and only 8 on the other; on XIV, 14+14; on XV, 14+10: posteriorly the number may increase to about 40 setæ per segment.

Accessory copulatory structures: the ventral surface of XI swollen for a space extending outwards on each side to about the second seta, with a pair of fossettes, one on each side of the median line, in front and ventrad of the first setæ, rarely a little further apart; a similar but less completely developed area in

some specimens on x; in one specimen none on x but a swelling and one fossette on XII. On XVII and on XX (on the latter sometimes more like the structures on XIX but a little closer together) the ventral surface in the interval devoid of setæ tumid, with two fossettes, one on either side of median line, which may be confluent; on XIX a pair of papillæ each with a fossette in front of the interval between the first and second setæ. The above is the typical arrangement; but specimens vary both in regard to the number of these structures and the extent to which they are developed; and there may be an additional one on XXI.

Dorsal pores commence after segment IV.

Hab.—Burrawang, N.S.W.

Var. c. (i):—Nine specimens 35-74 mm. long, 2-4 mm. broad; number of segments 82-95.

Spemathecals opposite the interval between the second and third setæ, or even opposite the third setæ.

Accessory structures: the whole ventral surface of x and XI as far dorsad on each side as about the third seta, raised and swollen; opposite the interval between the first and second setæ a pair of fossettes. A pair of papillæ on XVII, and a pair on XIX, closer than ♂ papillæ; a slight papilla on XVIII in median line in some specimens.

Hab.—Mt. Victoria, Blue Mts., N.S.W. (collected by Mr. A. G. Hamilton).

(ii):—Nine specimens not in good condition 36-50 mm. long, 2-3 mm. broad; number of segments 66-94.

Allowing for the poor condition of the specimens not distinguishable from the preceding; the accessory swellings on x and XI are as in that form, but though XVII, or XVII and XIX are modified, papillæ are not very evident.

Hab.—Raymond Terrace and Morpeth, N.S.W.

(iii):—Fifteen specimens 26-60 mm. long, 2-4 mm. broad: number of segments 75-115.

Not distinguishable from the foregoing. There are exactly similar swellings on x and xi, and at least indications of pairs of papillæ on xvii and xix in some of the specimens.

Hab.—Coonabarabran, Gunnedah from the banks of the Namoi, N.S.W. (collected by Mr. T. G. Sloane).

P. FECUNDA, Fl., [*l.c.* (2), II. (1887), p. 401], var. nov.

Twenty specimens 38-62 mm. long, 2-3 mm. broad; number of segments about 90-115.

Colour dark purplish iridescent superiorly and anteriorly as in the typical forms, lighter posteriorly, and quite pale on the ventral surface.

Setæ: On the preclitellar segments 24 (frequently only 20 or fewer with evident gaps in the half-circles, especially on the first setigerous segment (ii), but as examples can be found in which there are 12 on one or both sides of this segment the difference is evidently accidental); on some of the clitellar segments or just behind them the number usually increases to 28, but here and there only fewer can be counted; still further back the setæ are finer, closer together and more numerous, from about 30-40 when the half circles are complete.

Accessory copulatory structures: the ventral surface of segments x and xi outwards on each side to about the third or fourth seta swollen, with a pair of fossettes in front of and about opposite the second seta or the interval between the second and third setæ on each side (in immature specimens the general surface is less swollen, but the rudimentary circular shallow depressions or fossettes are in most cases recognisable). On xvi a circular raised area nearly filling the ventral interval devoid of setæ on this segment; a larger but elliptical area similarly placed on xvii (these two less evident when the girdle is developed); the ventral surface of xix as far outwards on each side as the third seta raised, like a pair of papillæ or pores in front and opposite the interval between the first and second setæ; xx somewhat similarly modified but not dorsad of the first seta, or the surface simply raised with a pair of fossettes, one on either side of median line.

Spermathecal pores two pairs, between VII and VIII, and VIII and IX, nearly opposite but a little dorsad of the second seta or as the margins of the apertures are tumid about opposite the interval between the first and second setæ.

Hab.—Burrawang, N.S.W.

Possibly distinct from *P. fecunda;* but a satisfactory series of the latter is still a desideratum.

The following four species were each described from a few mostly small specimens at a time when there seemed to be no immediate prospect of obtaining further material; during the period which has since elapsed I have had the opportunity of examining better series, from the examination of which I am now able to offer the following remarks partly supplementary to, partly in correction of, my original descriptions.

CRYPTODRILUS SACCARIUS, Fl., P.L.S.N.S.W. (2), I. (1886), p. 951.

The original description of this species was drawn up from the examination of half a dozen small specimens from Hornsby, in which for several reasons the slight irregularity of the rows of setæ did not attract particular notice. From further observations on a few additional specimens from the same locality, on a good series of specimens of what I regard as belonging to the same species from another locality, and on two other lots of specimens of what I consider as varieties, I now offer the following supplementary remarks.

Setæ: the eight rows of setæ never quite straight and regular throughout, the irregularity varying however within rather wide limits in different individuals; where regular the two rows of each outer couple not quite so far apart as the two couples of each side; all the rows at first regular and the two rows of each inner (ventral) couple continuing so throughout with the exception of a seta here and there out of place, or only slightly irregular, for some little distance in front of the posterior extremity (*i.e.*, in about

the posterior fourth or fifth of the body, except on about the last half dozen segments on which setæ are not visible) but with any tendency to irregularity more marked in the case of the second row of each of these couples; the rows of the two outer couples at first regular, in some specimens continuing so for a considerable distance (for the anterior half of the body, or even more) but sooner or later, or in others even on some of the pre-clitellar segments, the setæ of one or the other (most commonly the outer) and further back of both rows on each side of the body only here and there or continuously become displaced, at first slightly and then more and more markedly so that in about the hinder fourth or fifth of the body where always the two outer, and sometimes all four, rows of each side are out of place, the irregularity is sometimes very remarkable ; the setæ of the same rows on different segments may be quite close or widely separated, the setæ of different rows sometimes alternating roughly for a few segments. In one specimen five setæ were present on one and four on the other side of the same segment. Even in worms without girdles and undeveloped male papillæ I have not noticed the inner couples of setæ on segment XVIII.

The ventral surface of segment XVIII in all but very young specimens is more or less modified, most marked in mature worms with well developed clitella in which (in spirit specimens) there is usually a rather broad but shallow transverse depression bounded by a tumid rim, most thickened just round and a little beyond the ends of the depression which reaches on each side to a little beyond the second row of setæ, the depression a little narrower (from before backwards) for a little way on each side of the median line of the body, then widening out towards the extremities thus bearing some resemblance in shape to a dumb-bell, the papillæ with the male pores in but not quite at the extremities of the enlarged ends corresponding in position with the interval between the setæ of the inner couples, and confluent with the posterior slope of the depression so that the depressed area passes in front and beyond them ; sometimes a small papilla or only a little pit dorsad of each of the male papillæ. In less mature individuals the same arrange-

ments are indicated but are less developed, the depression not extending so far from side to side, its margins not so tumid, and its shape not so well-defined, and lying closer to the anterior than to the posterior margin of the segment. On the other hand as some specimens have the ventral surface convex but thickened for a space outwards on each side as far as about the second row of setæ, the thickening most marked towards the ends of the thickened area (which sometimes is dumb-bell-shaped from the extremities encroaching a little) it may be that the depression referred to is only or chiefly *post mortem* and due to the unequal contraction of a not uniformly thickened surface. Out of about 100 (spirit) specimens by far the majority of them show at least some indication of it. Individual variations in detail are common, and very frequently in the median line just behind the anterior margin of the segment there is one or a pair of dots or pits on a more or less distinctly thickened area resembling the accessory copulatory structure, or there may be one median, and two lateral dots or pits, in front of the ♂ papillæ. The supposed accessory copulatory structures vary in number, situation, and in pattern and size according to the extent to which they are developed. The first indication of each of them in immature worms is a pair (or there may be only one) of circular translucent dots or pore-like pits in the intersegmental groove (except in the case of those on the ventral surface of XVIII) one on either side of and not far from the median ventral line; on each side of the intersegmental groove a portion of the ventral surface of each segment becomes modified forming a lanceolate or nearly elliptical transverse thickening extending from the innermost (ventral) row of setæ on one side across the median ventral line to the innermost row of the other side, and from before backwards extending over one or part of one annulus or more of each pair of segments between which it occurs, the surface still completely traversed by the intersegmental furrow, or a portion of the latter completely enclosed; in more mature individuals the thickening increases, the pattern of the whole structure becoming more definite (lanceolate or nearly elliptical), the surface shallowly concave with an enclosing raised rim, or the

surface may be convex, in either case the dots or pits still visible on the surfaee. Sometimes the thickened areas are more elongate from side to side, and narrower from before backwards than at other times; sometimes the tissue only on one side of the intersegmental groove thickens; frequently the thickened area is constricted in the median line giving it a slight dumb-bell shape; sometimes the little pits are surrounded by a tumid rim irrespective of the general thickening or even become a pair of papillæ; they are usually intersegmental structures but occasionally they appear to belong wholly to the posterior of the two segments involved, and to be only apparently intersegmental by encroachment. As regards number and situation, there may be two preclitellar ones between segments XI and XII, and XII and XIII; and four postclitellar, one between XVIII and XIX, and three between any two segments from XX-XXIV, besides another on the ventral surface of XVIII, but some or any of them may be wanting; in my original specimens only the two preclitellar ones were present; in the subsequently acquired specimens a very common arrangement is one preclitellar one between XII and XIII, and two postclitellar ones between XX and XXI, and XXI and XXII, together with indications of something like them on XVIII.

Dorsal pores: the first few are not at all conspicuous in the specimens examined; the first one appears to be between XI and XII, but there may be a rudimentary one between X and XI.

Alimentary canal: the gizzard in segment V; five pairs of calciferous pouches in IX-XIII, overlying the intestine.

Hab.—The eastern portion of the County of Cumberland north of Port Jackson, N.S.W.

C. saccarius var. *montanus*, var. nov.

Three moderately contracted spirit specimens 50-67 mm. long, 3-4 mm. broad; number of segments about 140-180.

Two without girdles have the ventral surface of XVIII convex and tumid, most marked on each side from a little ventrad to a little dorsad of the inner couples, the thickenings bulging a little

antero-posteriorly; the third has a narrow transverse depression with a raised vein very much as in some specimens of the typical form.

All three have the supposed accessory copulatory structures, two in front and one behind the clitellum, but the former and occasionally the latter instead of being intersegmental may occupy the posterior two-thirds of XII, XIII, and XXI, or becoming only accidentally intersegmental by encroachment.

Alimentary canal: six pairs of calciferous pouches in segments VIII-XIII.

In other respects, so far as I know at present, agreeing with the typical form.

Hab.—Springwood, Blue Mts.

The number of calciferous pouches appears to be constant in this variety. Externally there is little to distinguish it from the typical form.

C. saccarius var. *robustus*, var. nov.

Eight well preserved rather contracted (spirit) specimens 112-195 mm. long, 9-12 mm. broad; number of segments from about 250-290: another very young specimen 59 mm. long, 5-6 mm. broad; number of segments about 215.

Accessory copulatory structures: usually one between XII and XIII, and in one specimen a postclitellar one between XXI and XXII (they have probably not attained their maximum development in any of the specimens). The ventral surface of XVIII in some of the specimens without clitella shows a papilla-like thickening in the position of the second seta of each side (N.B., the inner couples as in the typical form not visible on XVIII); in more mature specimens the thickening has increased, and in the area corresponding with the interval between the inner couples the anterior and posterior annuli have become depressed, the middle portion remaining as a distinct papilla apparently with the very inconspicuous male pores which are about in line with or a little

dorsad of the second row (*i.e.* a little dorsad of the position they occupy in the typical forms); ventrad of the papillæ the depressions may become confluent, and in the most mature (but still immature) examples they extend inwards, while the ventral surface between the papillæ shows a tendency to become modified and the depressions to be bounded by a raised rim. Translucent dots or little pits are commonly present on XVIII, one or two on each side in front, and two or three on each side behind the papillæ, the latter nearer to the median line.

The spermathecal pores are in front and dorsad of the first setæ on the margins of VIII and IX, a little more dorsad than in the typical form.

Dorsal pores: the first one appears to be that between XII and XIII, though there sometimes appears to be a rudimentary one between XI and XII; the first not always readily made out in my specimens, and on the clitellum blocked up.

Alimentary canal: six pairs of calciferous pouches in VIII-XIII.

In other respects agreeing substantially as far as I know at present with the typical forms. From the condition of the clitellum, the accessory copulatory structures, and the ventral surface of XVIII, evidently none of the specimens are quite mature.

Hab.—Near Gosford, N.S.W.

With the exception perhaps of *C. Tryoni*, the larger examples referred to above are the finest and most robust earthworms I have yet seen belonging to the genus *Cryptodrilus*. Nevertheless except in regard to size, the body comprising a few more segments, and the very slightly more dorsally situated male and spermathecal pores I am unable to make out any satisfactory important points of external difference from the typical forms. Irrespective of the presence of an additional pair of calciferous pouches there are so many points of agreement that, with var. *montanus* as an intermediate link, at present it seems to me to be best considered as a local variety inhabiting the rich soil of the brushes, the typical form and the var. *montanus* occurring in areas of good but much poorer soil, in the Hawkesbury sandstone area.

PERICHÆTA TENAX, Fl., l.c. (2), I. (1886), p. 953.

Ten good average (spirit) specimens out of about thirty are from 101-157 mm. long, 5-6 mm. broad; number of segments from about 116-150.

Setæ: when all are in place 36 may be counted on the first setigerous segment (II), which number continues for some distance until just behind the clitellum where 40 may often be counted; in the posterior region except on the last few segments the number may increase to about 50 or 60; fewer than the numbers specified may be met with in individual cases.

Clitellum comprises segments XIV-XVII and part of XIII.

Accessory copulatory structures: the characteristic structures present on IX and X may extend outwards on each side as far as the third or fourth setæ (*i.e.*, further out than previously mentioned) and in one case there is an additional one on XI; they vary somewhat in regard to the extent to which they are developed, and occasionally extend only half-way (antero-posteriorly) across the segment. In addition to these there are certain other structures often only represented by vaguely defined swellings; on the ventral surface of XVII and of XIX is a pair of circular depressions, one on either side of and not far from the median line and immediately in front of a line joining the first (ventral) seta on each side, each surrounded by a more or less circular tumid rim, the two of each pair merely contiguous or more or less confluent; and often a single median one on XVIII. In sexually mature worms the papillæ carrying the male pores are situated (in spirit specimens) on the inner aspect (probably more evident owing to shrinkage in the middle) of two much bigger swellings extending antero-posteriorly across the segment, frequently pitted; in immature worms one may find an earlier stage showing five little pits with tumid surroundings forming an interrupted ridge, of which the middle one persists without much alteration, the first on each side of it being a male pore with its rudimentary papilla, and the second eventually becoming so much developed as to overshadow the papillæ of the ♂ pores.

Hab.—The County of Cumberland; Springwood, Blue Mts., N.S.W.

PERICHÆTA DORSALIS, Fl., *l.c.* (2) II, (1887), p. 618.

A good series of 35 specimens of various sizes, some very successfully killed in a fairly extended condition by Mr. Smith, comprising examples from 60 mm. long, 3 mm. broad (juv.) to 192 mm. long, 5-7 mm. broad; number of segments about 135.

Setæ: the full number (probably about 16) not present on the first setigerous segment (II) in any of the specimens, though a few have six setæ visible on at least one side of the body; the first and second (counting from the ventral ends of the half series) are rarely absent, and these may be the only ones visible; the next few segments usually have 16, increasing to 20 about segment VI; in one of the original specimens there are 12 on one side of segment XII, but this number is exceptional so far forward; still further back, except on about the last six or seven segments which are smooth, there may be about 30 or a few more. Fewer setæ than the numbers specified may be met with. The statement that the dorsal interval devoid of setæ is somewhat narrower than the ventral one applies only to the posterior region, or elsewhere only to particular individuals; as a rule anteriorly the dorsal interval is much broader than and not so well defined as the ventral one, its bounding rows of setæ not being straight since the setæ are not always at equal distances apart even on the same segment, or that some of them are absent, or posteriorly to the increasing number of setæ. The ventral interval is well-defined, its bounding rows straight and regular, the setæ in this region without the varying tendency to be absent so characteristic of those in the dorsal region. Even in young worms without clitella or papillæ however the first two or three setæ on each side of the ventral surface of XVIII are not visible, and are probably normally absent.

Genital pores: in worms in which the papillæ are not much developed the male pores are two conspicuous slit-like pores a little dorsad of what would be the position of the second seta on

each side, and corresponding with the interval between the second and third setæ; in mature worms the ventral surface of segment XVIII on each side from about the position of the first to the fourth seta all round the male pores is very tumid forming a conspicuous papilla bulging somewhat both forwards and backwards, more or less concentrically furrowed; and from the male pores there protrude what are probably functionally penial organs, though they appear to be only the proximal portions of the genital ducts everted. The oviduct pore is single (not as previously stated); the spermathecal pores are more dorsally situated than in any species I have yet seen; owing to the irregularity of the setæ they are not always "in line with about the eighth setæ," but may be as far dorsad as opposite the interval between the ninth and tenth setæ.

The supposed accessory copulatory structures on X and XI present in the largest of the original specimens are absent.

Genitalia: in addition to the three pairs of vesiculæ seminales in IX, XI, and XII there may be two additional rudimentary pairs in XIII, and XIV (unless the last of these, situated on the posterior face of the septum between XIII and XIV below and at the sides of the alimentary canal, should be appendages of the oviducts). The long cæca of the spermathecæ may be much longer than the pouches.

Hab.—Eltham, Victoria (collected by Mr. W. W. Smith).

In addition to the fine series of worms, Mr. Smith, who is a most enthusiastic observer of earthworms, very kindly sent me a number of the cocoons together with portions of the burrows, respecting which I give the following extracts from his letter:— "I send you fragments of the burrows of *P. dorsalis* with cocoons *in situ* to show their position with regard to the burrows. Several writers on the subject maintain that they are found in the burrows themselves, but I have never yet met with a single instance of such a thing, although I have examined hundreds of the burrows of New Zealand worms. You will see from the fragments sent that the cocoons are deposited by the worms on an average about

half an inch from the burrows in little cavities which are afterwards neatly packed with voided earth, forming moist chambers." The cocoons sent varied slightly in shape from nearly spherical to ovate, or almost elliptical, from 5 × 4·5 mm. to 6 × 4 mm.; colour yellow or dull yellowish-brown; usually with one end slightly drawn out; one cocoon contained an embryo 15 mm. long; the others had been more recently deposited, but owing to an unfortunate accident which befel them I am unable to give any further particulars respecting them. These are the only cocoons of Australian earthworms I have yet seen, as though I have collected extensively I have not so far had the good fortune to meet with them.

PERICHÆTA STIRLINGI, Fl., l.c. (2), II. (1887), p. 395.

An additional series of 14 good specimens very successfully killed in a fairly extended state by Mr. Zietz comprises examples from 105 mm. long, 3-4 mm. broad (juv.) to 220 mm. long, 9-10 mm. broad; number of segments 120-190-200 segments.

Setæ: the full number (probably about 24) not present on the first setigerous segment (II) in any of the specimens, though a few have 10 on at least one side of the body, but even then one or two are probably missing, the tenth seta (counting from the ventral surface) not being so near the mid-dorsal line as the uppermost setæ on succeeding segments; on the next two segments 12 or 13 may be met with at least on one side; on the following segments for some distance the number may increase to 14 on one or both sides; still further back 16-18 may occur on one or both sides, and quite posteriorly the total number may increase to 40 or a few more per segment. As in other species fewer setæ than the numbers specified for the different regions may frequently be met with; and while the variation in number on some segments is evidently due to the mere accidental absence of setæ owing to breakage or wear and tear, in other cases it is owing to the frequent absence of one or two or more of the uppermost (dorsal) setæ of the half-series, and this in the absence of any definite information as to the dorsal

rows being more exposed to wear and tear than the ventral ones seems to be attributable to a tendency to a reduction in the number of setæ commencing with those in the dorsal region, as the ventral setæ and especially the first and second of each half series are remarkably constant in their presence even on segment II, on which sometimes the total number visible is only three or four.

The ventral interval devoid of setæ is very well marked throughout, but anteriorly where the setæ are fewer and further apart, and as elsewhere, not always at equal distances apart even on the same segment, its width may be much less than that of an ordinary interval between two setæ. The dorsal interval is narrower.

In mature worms in which the ventral surface of XVIII is more or less modified the first visible seta on each side is usually the third or fourth (counting from the ventral ends of the half-series); in an immature specimen on which the surface of this segment is unmodified and the ♂ pores quite distinct the first two on each side are wanting or invisible, and the pores are seen to be in what would be the interval between the second and third setæ but a little dorsad of the position of the first setæ; from the unequal distances between the setæ, or from the third or fourth setæ being hidden by the tumidity of the ventral surface, one is often obliged to judge of their position by that of the setæ on the preceding or succeeding segment, and then the pores sometimes seem to correspond with the interval between the third and fourth setæ. The oviduct pore is single and median (not two pores as previously stated); owing to the irregularity of the setæ the spermathecal pores are sometimes opposite the intervals between the fourth and fifth or more usually the fifth and sixth setæ.

Dorsal pores commence after segment IV.

In mature worms the tissue round the male pores becomes modified, or they are surrounded by a tumidity connecting the accessory copulatory papillæ of the second and third pairs on each side.

Genitalia: two pairs of testes and two pairs of ciliated rosettes in X and XI; three pairs of vesiculæ in XI-XIII (in XIV there may

be what look like a rudimentary fourth pair); the genital duct in the additional specimens dissected is rather long and several times bent on itself, and the two vasa deferentia of each side appear to remain separate and to join the prostatic duct about half the length of the latter from the gland. The spermathecal cæca may be as long or a little longer than the duct of the main pouch.

The numerous nephridial tubules lie just behind the insertions of the mesenteries.

Hab.—(As previously) near Adelaide, S.A. *(Coll. S.A. Museum, Adelaide).*

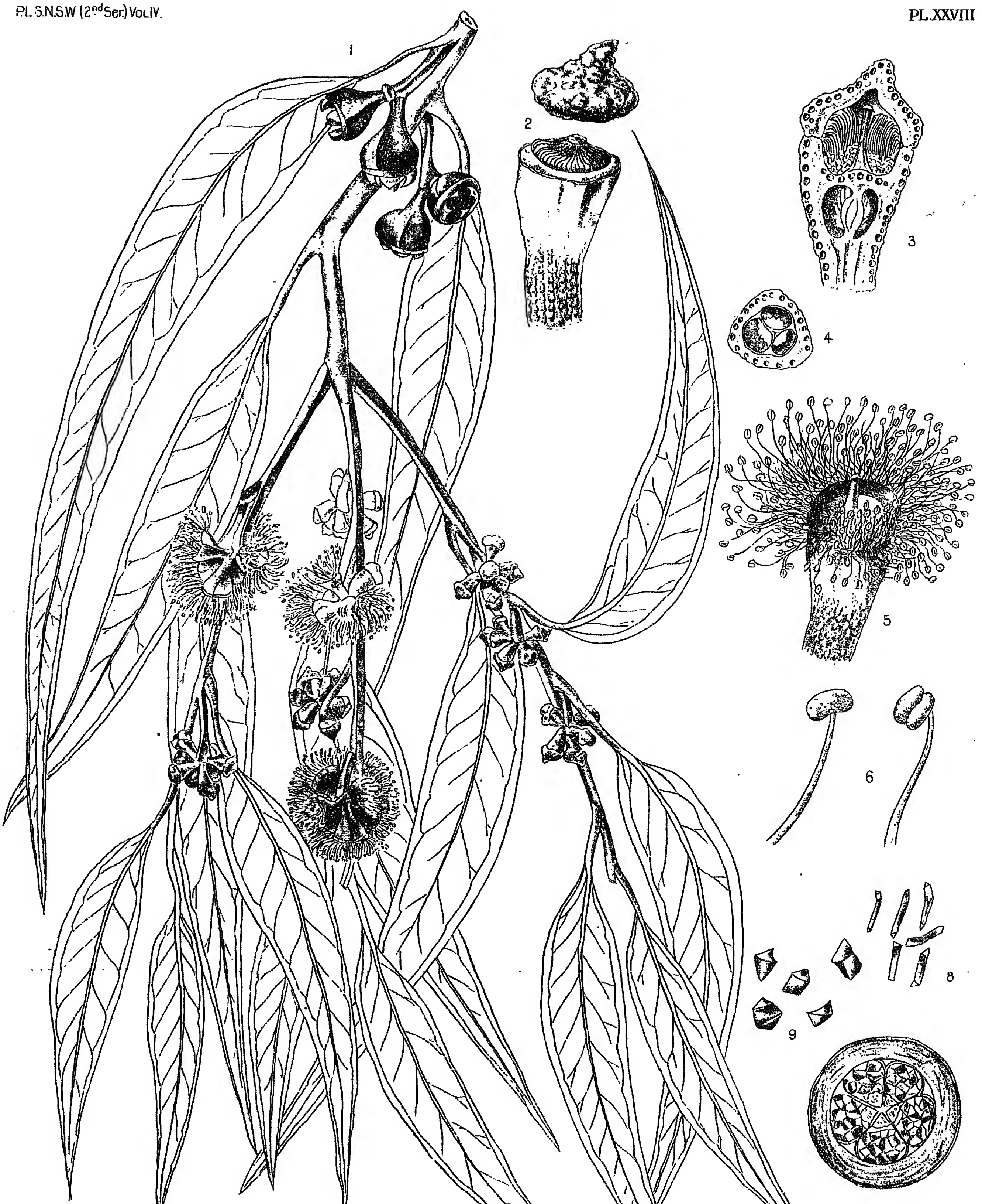
NOTES ON A NEW SPECIES OF *EUCALYPTUS* (*E. MAIDENI*) FROM SOUTHERN NEW SOUTH WALES.

By Baron von Mueller, K.C.M.G., M. & Ph.D., F.R.S., &c.

(Plates xxviii. and xxix.).

Finally tall; branchlets slender, quadrangular at the end; leaves scattered, of rather thick consistence, copiously dotted, narrow-elongate or sometimes broad-lanceolar, distinctly or somewhat sickle-shaped; the petioles from ½ to 1 inch in length, the lateral veins spreading and slightly prominent underneath, the circumferential vein distinct and rather remote from the edge of the leaf; young shoots quadrangular, their leaves broadly cordate with a small pointed apex, opposite and of a whitish hue underneath, petioles almost absent; umbels axillary, on angular stalks about ½ inch long, dilated towards the top, bearing 2 to 9 flowers of rather large size, stalklets none or exceedingly short; calyx-tube obconical, angular, warty-glandular, especially at the base; lid depressed hemispherical, suddenly raised in the centre to a thick point, like the calyx-tube warty-glandular; stamens all fertile, inflexed before expansion; anthers oblong kidneyshaped; stigma slightly broader than the style, depressed; ovulary 3- to 5-celled; fruit ¼ inch in thickness, nearly hemispherical, its rim broad, convex, at the edge separated from the calyx-tube by an ample furrow; seeds all without any appendage, the sterile narrower and longer than the fertile seeds.

In rich soil only on steep mountain-slopes from the southern boundary as far north as the Braidwood and Nelligen districts (W. Bäuerlen).



1 Twig with expanded flowers, buds, leaves & fruits Nat. size

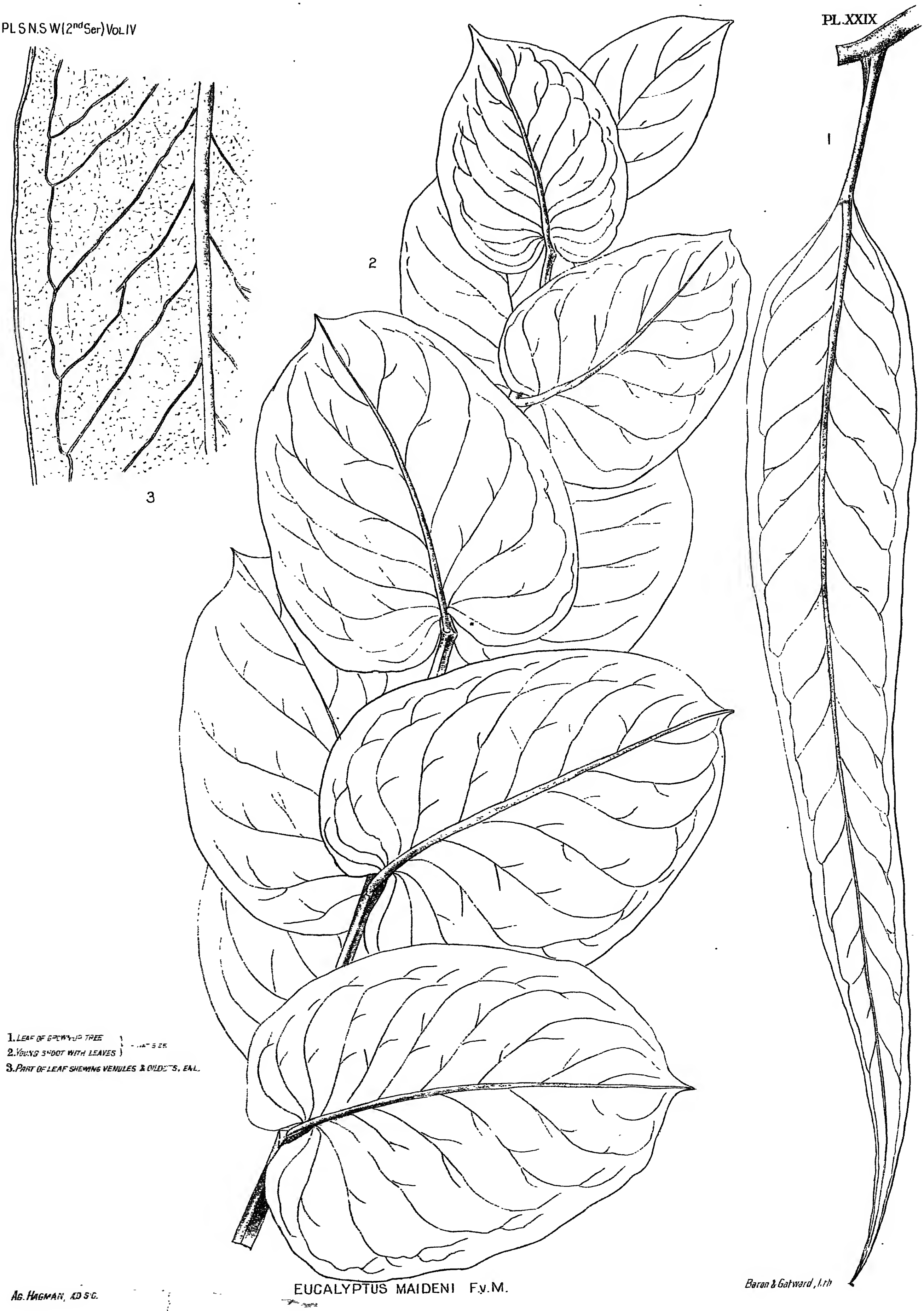
Enlarged:
2 Calyx-tube with lid uplifted
4 Transverse section of ovulary
6. Anthers with filaments
8. Sterile seeds

Enlarged:
3 Longitudinal section of an unopened flower
5. Flower expanded
7. Tranverse section of fruit
9. Fertile seeds

H. Hagman, ad sic.

EUCALYPTUS MAIDENI Fv.M.

Baron & Gatward, lith



1. Leaf of grown-up tree } nat. size
2. Young shoot with leaves }
3. Part of leaf shewing venules & oildots, enl.

Ag. Hagman, ad s'c.

EUCALYPTUS MAIDENI F.v.M.

Baron & Gatward, Lth

A tree, locally known as White, Blue or Spotted Gum; in favourable situations attaining a height of 200 feet and a diameter of 4 feet. Stem usually very straight, and much elongated. Bark smooth and usually bluish or greyish, sometimes with long drawn patches or spots, sometimes rather white, at other times of a dull ochre-yellow colour. In general appearance the tree and bark resemble a good deal that of *Euc. goniocalyx*, so much so that on mountain-slopes, where both species promiscuously occur, it is difficult to distinguish the one from the other, when so situated, that the fruit on the ground is so mixed, that it can not be traced with certainty to its particular tree. If however leaves of the young state can be seen, then the distinction is easy enough, as those of *Euc. goniocalyx* are never quite so broad nor of such chalk-like whiteness. Where the fruit can be traced, no mistake can be made, as they are so widely different, and resemble more those of *E. globulus.*

It has very little kino, and from that fact one would judge, that it is a good timber. Somehow or other it is not much used, which is, no doubt, to a certain extent owing to its situation, mostly difficult of access, and also to the fact, that in situations where it occurs, other valuable and time-proved timbers do occur, such as *E. tereticornis*, *E. hemiphloia*, *E. goniocalyx*, *E. melliodora*, *E. eugenioides*, etc. The timber is, however, used for fencing, both for rails and posts, also for rough building purposes and to a certain extent for wheelwright work. As posts, it is said, it lasts fairly well, and it makes excellent rails. The timber is *very heavy*, hard and of a rather pleasing yellow colour, not somewhat brownish as that of *E. goniocalyx.*

EXPLANATION OF PLATES.

(PLATE XXVIII.)

Fig. 1.—Twig with expanded flowers, buds, leaves and fruits. (Nat. size.)

Fig. 2.—Calyx-tube with lid uplifted.

PLATE XXVIII.—*continued:*

Fig. 3.—Longitudinal section of an unopened flower.
Fig. 4.—Transverse section of ovulary.
Fig. 5.—Flower, expanded.
Fig. 6.—Anthers with filaments.
Fig. 7.—Transverse section of fruit.
Fig. 8.—Sterile seeds.
Fig. 9.—Fertile seeds.

(Figs 2-9 enlarged.)

(PLATE XXIX.)

Fig. 1.—Leaf of adult tree. (Nat. size.)
Fig. 2.—Young shoot with leaves. (Nat. size.)
Fig. 3.—Part of leaf showing venules and oildots. (Enlarged.)

NOTES ON A SMALL COLLECTION OF BIRDS MADE BY Mr. E. H. SAUNDERS, AT ROEBURNE, NORTH-WESTERN, AUSTRALIA.

By A. J. North, F.L.S.

Roeburne, of which Cossack is the port, is the centre of the pearling industry in North-western Australia. It is situated near the mouth of the Harding River, and is about 800 miles in a direct line from Perth, and 500 miles from Derby, King's Sound. The adjacent country is rich in minerals; gold was accidentally discovered there early last year by a boy, who picking up a stone to throw at a bird, found it to be closely veined with gold. Inland the country has been mostly devoted to pastoral purposes, the exact locality where this collection was made being Karratha Station, 36 miles N.W. of Roeburne. With one or two exceptions only the larger species have been collected, and although a new locality, only two species are recorded as typical of Western Australia, viz., *Platycercus zonarius*, Shaw, common in the south, and *Dacelo cervina*, Gould, already reported by Dr. Ramsay, from Derby. The rest are common in New South Wales and other parts of Australia, and merely show the range of the species. Mr. Saunders has attached a note to each specimen, giving the date when collected, sex, and the colours of those parts liable to fade.

Circus assimilis, *Jardine and Selby* (*C. jardinii*, Gould).

Allied Harrier.

A semi-adult ♂ shot May 3rd, 1889. Found over the greater portion of Australia.

Haliaetus leucogaster, *Gmelin.* White-bellied Sea-eagle.

A young ♂ shot near a lagoon, May 15th.

Mr. Saunders attached the following note to this specimen. "Contents of stomach, eels. The reason I believed the contents of the stomach to be eels, was because the bird's feet were covered with mud when shot. The lagoon called "Marie" is a large one and eels are numerous. I could not discern the heads of the eels taken from stomach."

Haliastur sphenurus, *Vieillot.* Whistling Eagle.

A single specimen of this bird, a young male. With the exception of the extreme south this species is universally dispersed over the Continent of Australia.

Elanus axillaris, *Latham.* Black-shouldered Kite.

An adult ♀, similar in every respect to our New South Wales examples.

Hieracidea orientalis, *Schlegel.* Brown Hawk.

A single specimen, not quite adult male, shot May 2nd at Karratha Station. Similar in every respect to specimens from the eastern coast.

Tinnunculus cenchroides, *Vig. & Horsf.* Nankeen Kestrel.

Adult specimens, ♂ and ♀, similar in tints of plumage and admeasurements to New South Wales examples.

Merops ornatus, *Latham.* Bee-eater.

An adult ♂ specimen, shot April 29th at Karratha Station. This bird is universally distributed over the whole of Australia.

Dacelo cervina, *Gould.* Fawn-breasted Kingfisher.

Two adult specimens obtained, ♂ and ♀, of this northern and north-western form of *D. leachii.* In both of these species the deep rich blue of the upper surface of the two central tail feathers of the male will at once serve to distinguish it from the female, which in striking contrast has the central tail feathers of a rich brown conspicuously barred with black.

HALCYON SANCTUS, *Vig. & Horsf.* Sacred Kingfisher.

One adult and one semi-adult ♂. Similar to the New South Wales examples. Found all over Australia.

CENTROPUS PHASIANUS, *Latham.* Pheasant-Coucal.

A single adult ♂ specimen shot May 1st at Karratha Station. This species is precisely similar to that obtained on the Clarence and Richmond Rivers, some specimens varying more or less in the deeper tints of the under surface of the body.

CALOPSITTACUS NOVÆ-HOLLANDIÆ, *Gmelin.* Cockatoo-Parrakeet.

Two males, not quite adult.

PLATYCERCUS ZONARIUS, *Shaw.* Banded Parrakeet.

Two semi-adult ♀ specimens. This bird is the only typical Western Australian species in the collection. Although very common in portions of Southern and Western Australia, neither this nor any other species of *Platycercus* has been recorded in Dr. Ramsay's List of Birds from Derby.

ÆGIALITIS NIGRIFRONS, *Cuvier.* Black-fronted Dotterel.

Two adult specimens, ♂ and ♀, shot May 3rd. With the exception of the extreme north this bird is universally dispersed over the whole of Australia.

ARDEA NOVÆ-HOLLANDIÆ, *Latham.* White-fronted Heron.

An adult ♀ similar in every respect to New South Wales examples. With the exception of the Gulf district and Cape York this bird is found all over Australia.

TRIBONYX VENTRALIS, *Gould.* Black-tailed Tribonyx.

Three specimens shot April 23rd, two adult males and one female, similar in tints of plumage and admeasurements to those obtained from other portions of the Australian Continent.

FULICA AUSTRALIS, *Gould.* Australian Coot.

A ♂ shot April 24th. After careful comparison with specimens from New South Wales and Victoria, I can find no distinction between them.

PLOTUS NOVÆ-HOLLANDIÆ, *Gould.* New Holland Darter.

An adult ♂ shot April 29th. This bird seems to be universally dispersed over the whole of Australia. Dr. Ramsay has recorded both this and the two following species from Derby, North-western Australia (P.L.S.N.S.W. Vol. II. 2nd Series, p. 173) but through an oversight they have been omitted from his "Tabular List of the Birds of Australia."

GRACULUS MELANOLEUCUS, *Vieillot.* Little Cormorant.

One specimen, a female, shot May 17th at "Marie," a lagoon 36 miles S.W. of Roeburne. Similar to those procured from other portions of Australia and Tasmania.

GRACULUS STICTOCEPHALUS, *Bonaparte.* Little Black Cormorant.

Two adult specimens, ♂ and ♀, shot May 10th at Karratha Station. With the exception of the extreme north, this species has been obtained from every part of Australia.

DESCRIPTION OF A NEW SNAKE BELONGING TO THE GENUS *HOPLOCEPHALUS*.

By J. Douglas Ogilby, F.L.S.

Hoplocephalus frontalis, *sp.nov.*

Scales in nineteen rows; abdominal plates 154; anal plate undivided; sub-caudal plates 30. Body elongate and rounded, tail short, terminating in a strong spinate scale; head small, but little distinct from the trunk; muzzle short, broad, and rounded; eye small, the pupil sub-elliptical. Rostral shield twice as broad as high, rounded above, and slightly bent backward between the anterior frontals, which are of moderate size and broader than long; posterior frontals much larger, as broad as long, obtusely angulate posteriorly, and *bent downwards on the side of the head so much so as to form a broad suture with the second upper labial;* nasal shield triangular, small; vertical hexagonal, rather longer than broad, with the outer margins slightly convergent behind, the anterior angle very obtuse, and the posterior rounded; supra ciliary large; occipitals large, rounded posteriorly; one anterior ocular, just reaching to the upper surface of the head; two posterior oculars, the lower of which is the larger; temporal shields in two series, the lower shield of the anterior series in contact with both post-oculars; six upper labials, the third and fourth bordering the eye; mental shield acutely angulated posteriorly; anterior chin shields rather larger than the posterior; many small scales between the chin shields and the first abdominal plate. Four small teeth behind the poison-fang. Light brown above each of the scales narrowly margined with black, so as to give the appearance of network; a broad black nuchal collar, extending forwards over portions of the upper labials, temporals, and the lower posterior ocular to the eye; a black spot in front of the eye on the upper

third of the second and third upper labials; a black vertebral band, one scale in width, not continued on the tail; lower head shields grey with irregular dusky blotches; under surface pearly white, the abdominal plates with a broad bronze-colored median band.

This handsome and very distinct species was presented lately to the Australian Museum by Mr. J. Mozeley, who obtained it at Narrabri; its total length is 15½ inches, of which the tail measures less than 2 inches, or one-eighth of the total. In the great lateral extension of the posterior oculars this species approaches Dr. Günther's genus *Rhinelaps* which in all probability will eventually have to be merged in *Hoplocephalus.* Register number R. 655.

NOTES AND EXHIBITS.

Mr. Ogilby exhibited (1) a very handsome Lizard *(Lygosoma—Homolepida—casuarinæ,* D. & B.) from Wentworth Falls, and remarked that it was the largest species of the genus, exceeding even *Lygosoma—Hinulia—lesueuri* in size ; also that he considers it a scarce species; (2) a young specimen of *Hoplocephalus ornatus,* De Vis; (3) *Holocanthus tibicen,* C.V., a fish new to the Australian fauna, and apparently scarce everywhere, recently brought from Lord Howe Island by the Visiting Magistrate, Mr. Icely; Mr. Ogilby further remarked that in the small collection brought by that gentleman no less than seven species are hitherto unrecorded from the island, namely *Holocanthus tibicen, Chironemus marmoratus, Trachynotus russelli, Brama rayi, Pegasus draco, Cristiceps australis,* and an *Ophichthys.*

Mr. Etheridge exhibited specimens of the fossils dealt with in his paper.

Mr. Trebeck showed an exhibit of wool which, originally a low class dirty wool, by a process followed in Germany had been immensely improved and converted into what is technically known as "tops."

Mr. North exhibited the birds mentioned in his paper, and also drew attention to the number of Australian Finches now in the Sydney Market, among which he pointed out several rarities, viz.: *Donacicola pectoralis*, Gould; *Poëphila mirabilis*, Homb. et Jacq.; *Pöephila leucotis*, Gould; and *Bathilda ruficauda*, Gould, obtained midway between Townsville and Normanton, Northern Queensland.

Mr. North also communicated the following "Note on the successful hatching of an egg of the Emu, *Dromaius novæ-hollandiæ*, under a domestic fowl":—

"I beg to bring under the notice of the members of this Society the success attending the hatching of an emu egg under a domestic fowl. Mrs. M. Walker, of Newtown, Sydney, has in her possession a pair of emus, *Dromaius novæ-hollandiæ*, obtained from Queensland; early in July last the female laid several eggs, one of which was by way of experiment placed under a common barn-door fowl on the 15th of July. The hen sat very well for two weeks, when she became restless, and another one was immediately put in her place, the egg being regularly turned every morning, as it was too cumbersome for the fowl. On the 2nd of September, the young bird emerged from the shell, strong and healthy, and was thriving very well, till turned out upon a grass plot for a run seventeen days after, when it was attacked by one of the emus and never recovered. The exact period of incubation would therefore in this case appear to be seven weeks. The young bird and remaining portions of the egg-shell which I exhibit here to-night have been presented by Mrs. Walker to the trustees of the Australian Museum. The female is now sitting on six eggs, and five others have been placed in an incubator; the last egg laid is of a deep bluish-green, perfectly smooth and free from granulation."

Mr. Brazier exhibited the Mollusca trawled by Mr. Smithers off Merimbula, and *Crassatella pulchra*, Reeve, found by Mr. E. Richards, of Ballina, Richmond River.

Dr. Ramsay exhibited two mounted specimens of a new species of *Belideus* about the size of *B. flaviventer*, but of a light ashy gray colour, almost white on the proximal portion of the tail, which is thick, bushy and well covered with long hair to the tip; the under surface of the body is white. These specimens have been recently received from the Museum collectors, Messrs. Cairn and Grant, who obtained them with other new species of Phalangers on the Bellenden Ker Ranges, North Eastern Queensland. The *Belideus* will be described under the name of *B. cinereus.*

Dr. Ramsay also exhibited a new species of *Pseudochirus* (Phalanger) with a remarkably short head and long bushy tail, for which the specific name of *breviceps* has been proposed.

Mr. Skuse exhibited specimens of the Tipulidæ described in his paper.

Also specimens of a minute Dipterous fly, *Phytomyza* (sp.n.), bred from the leaf of *Clematis aristata*, obtained in the beginning of the present month by Mr. J. J. Fletcher. The larvæ make long irregular white galleries beneath the upper cuticle of the leaf, where they undergo their metamorphoses.

WEDNESDAY, 30TH OCTOBER, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

Mr. Bäuerlen was present as a visitor.

The President stated that it became his painful duty to announce to the Members of the Society the death of the Rev. Julian E. Tenison Woods, F.L.S., F.G.S., a Vice-President of the Society, on the 7th instant. The late reverend gentleman was elected a Corresponding Member in 1876, became subsequently a full member, and in 1879 and 1880 filled the Presidential Chair. Throughout his long residence in Australia he was an active and enthusiastic worker in the fields of Biology and Geology, and he contributed a considerable number of valuable papers to the various Colonial Scientific Societies' Journals.

DONATIONS.

"Mémoires (Sapiski) de la Société des Naturalistes de la Nouvelle-Russie, Odessa." Tome XIV., Part 1 (1889); "Sapiski Matematischeskago, &c." Tome IX. (1889). *From the Society.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 314-316 (1889). *From the Editor.*

"Revista de Sciencias Naturaes e Sociaes orgão dos trabalhos da Sociedade Carlos Ribeiro." Vol. I., No. 2 (1889). *From the Society.*

A Pamphlet entitled "A new Hepatic." By Dr. B. Carrington and W. H. Pearson. *From W. H. Pearson, Esq.*

"Papers and Proceedings of the Royal Society of Tasmania for 1888;" "Abstract of Proceedings, Aug. 19th and Sept. 9th, 1889;" "Report for the year 1888." *From the Society.*

"The Gold-Fields of Victoria.—Reports of the Mining Registrars for the quarter ended 30th June, 1889;" "Report of the Secretary for Mines on the Mineral Statistics of Victoria for the year 1888." *From the Secretary for Mines, Melbourne.*

"The Journal of the Bombay Natural History Society." Vol. IV., No. 2 (1889). *From the Society.*

Feuille des Jeunes Naturalistes." No. 227 (Sept., 1889); "Catalogue de la Bibliothèque." Fasc. No. 6 (1889). *From the Editor.*

"Results of Meteorological Observations made in N.S.W., during 1887, under the direction of H. C. Russell, B.A., F.R.S;" Three Pamphlets from the "Proceedings of the Aust. Assoc. for the Adv. of Science, 1888." By H. C. Russell, B.A., F.R.S. *From the Government Astronomer.*

"The Victorian Naturalist." Vol. VI., No. 6 (October, 1889). *From the Field Naturalists' Club of Victoria.*

"Bulletin of the Museum of Comparative Zoology at Harvard College, Cambridge, U.S.A." Vol. XVII., No. 4 (1889). *From the Curator.*

"The Chemist and Druggist." Vol. XXXV., No. 490 (1889); "The Chemist and Druggist of Australasia." Vol. IV., No. 10 (Oct., 1889). *From the Publisher.*

A Pamphlet entitled "Notes on the Discovery of a Ganoid Fish in the Knocklofty Sandstones, Hobart." By Messrs. R. M. Johnston and A. Morton. *From Alexander Morton, Esq.*

"Proceedings of the United States National Museum." Vol. XI. (1888), Sheets 28-33. *From the Museum.*

"The Canadian Record of Science." Vol. III., No. 7 (1889). *From the Natural History Society of Montreal.*

"Records of the Geological Survey of India." Vol. XXII., Part 3 (1889). *From the Director.*

"The Australasian Journal of Pharmacy." Vol. IV., No 46 (Oct., 1889). *From the Editor.*

"The Journal of Conchology." Vol. VI., No. 3 (1889). *From the Conchological Society of Great Britain and Ireland.*

"Mittheilungen aus der Zoologischen Station zu Neapel." Bd. IX., Heft. 1 (1889). *From the Zoological Station.*

"Annales de la Société Géologique de Belgique." Tomes XIV., Liv. 2; XVI., Liv. 1 (1889). *From the Society.*

"Bulletin de la Société Zoologique de France pour l'Année 1889." Tome XIV., No. 6 (1889). *From the Society.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CIX., Nos. 4-7 (1889). *From the Academy.*

"Annual Report of the Trustees of the Queensland Museum, 1888." *From the Curator.*

"The Proceedings of the Royal Society of Queensland, 1889." Vol. VI., Part 5. *From the Society.*

A Pamphlet entitled "The Physiography of the Australian Alps." By James Stirling, F.G.S., F.L.S. *From the Author.*

"Transactions and Proceedings of the New Zealand Institute, 1887." Vol. XX. *From the Institute.*

A Pamphlet entitled "Bryozoa from New South Wales." By Arthur W. Waters. *From the Author.*

PAPERS READ:—

DESCRIPTIONS OF TWO LIZARDS OF GENERA NEW TO AUSTRALIAN HERPETOLOGY.

By C. W. De Vis, M.A.

SCINCIDÆ.

Tropidophorus queenslandiæ, n.sp.

Anterior head-shields rugose; those of the parietal and occipital regions nearly smooth. Frontonasals two, thick, convex, deeply sulcated. An azygos shield between the prefrontals; prefrontals and anterior portion of frontal similar. Prefrontals and frontals together about equal in length to the shields posterior to them. The frontals porous in structure microscopically, thin, with a few minute irregularly disposed raised lines and tubercles on the surface; the shields rather obscurely defined as frontoparietals (two), interparietal and occipitals: the interparietal a little longer than the frontoparietal and with the "pineal eye" speck as a glistening, apparently semitranslucent cornea contrasting with the surrounding surface. Supraoculars five, subequal, strongly ribbed longitudinally; supraciliaries seven, limited posteriorly by the last and smallest supraocular; a row of keeled scales below the eye. Upper labials five. An azygos postmental. Tympanum as long as the eye-slit. Scales in 32-34 rows; dorsals in 10 rows, of which the median rows are the smallest, the laterals largest; all with strong tectiform keels forming continuous subspinose lines. Scales of the flanks smaller than the lateral dorsals, similarly keeled, in longitudinal lines; of the upper surface of the tail much larger, more feebly keeled but mucronate and forming spinous ridges; of the temples like those of the middle of the back; of

the throat and sides of the neck small and similarly keeled; of the abdomen as large as the lateral dorsals but with linear central keels becoming mucronate on the lower surface of the tail. Two large preanals. Tail rounded: about a fourth longer than the head and body. Subdigital lamellæ simple. The protracted hind limb reaches the retracted elbow. Teeth obtuse, molar-like. Dark brown above, with faint alternate cross-bands of paler brown and fuscous; beneath pale dingy brown. Chin dark brown with white band-like spots; preanals white; base of tail beneath marbled with white. Total length 125 mm., tail 70, head 17, width of head 9, of body 11, fore limb 17, hind limb 25.

Locality.—Herberton and Bellenden Ker, in scrubs.

The nearest relative of this lizard is *T. grayi*, Gth., of the Philippine Islands. The obtuseness of the teeth and rudimentary conditions of the posterior head-shields may possibly lead to the establishment of a new genus for its reception.

GECKONIDÆ.

PEROCHIRUS MESTONI, n.sp.

Head rather depressed, a little convex on the frontal and concave on the parietal region. Snout obtusely pointed, longer than the postocular portion of the head and nearly twice the diameter of the eye. Body rotund, limbs short and massive; digits short, broad, almost free and all dilated; the thumb and outer toe moderately developed and furnished with very small claws; the free phalanges of the fourth toe much shorter than the diameter of the eye. Ear opening small, round. Rostral (injured) apparently thrice as broad as high; mental subrhomboidal, its posterior angle entering between a pair of moderately elongate postmentals which are followed by a pair of smaller ones; between these are granular scales larger than those of the throat. Head with granules which are larger on the snout than on the crown. Upper surface and throat with small granules somewhat larger than those of the

crown. Abdomen with imbricated scales of moderate size. Tail, if not reproduced, round, fusiform, tapering, about as long as the head and body, covered with imbricated scales about as large as the abdominals; on the median line below a series of elongate transverse scutes commencing caudad of a seeming line of fracture near the base. No femoral or preanal pores. Above vinous-grey, flecked and stained with dark grey; below dull purple. Length 106 mm., head 15, tail 52, fore limb 14, hind limb 18, width of head 11.

Locality.—Bellenden Ker; collected by Mr. A. Meston.

I do not conceive that the greater degree of development of the imperfect digits and the presence of subcaudal scutes, if normal, are valid objections to this lizard being referred to *Perochirus.*

A REVISION OF THE AUSTRALIAN SPECIES OF *EUPLŒA*, WITH SYNONYMIC NOTES, AND DESCRIPTIONS OF NEW SPECIES.

By W. H. Miskin, F.E.S.

The Australian species of this genus are more numerous than have been hitherto supposed, and with the view of collating and arranging them in some order the following observations are offered. Upon examining the structural characters of the various groups, I find them so conflicting that I have been quite unable to arrange our species according to the subdivision of the old genus proposed in the various articles by Messrs. Moore and Butler, and feel constrained to retain them all under the one genus.

The following table will in some degree explain my meaning:—

A. Outer margin of primaries rather convex.

  a. Hinder margin of primaries in ♂ considerably convex .... *niveata.*

    aa. With colourless oval patch on upperside of costa of secondaries in ♂........ .. *Tulliolus.*

      aaa. Sexual brands or scent glands none ? *Darchia.*

    bb. Without costal patch.

      bbb. Brands none........ *Misenus.*

    cc. With costal patch .... *Hippias.*

      ccc. Brand single, oval shape; present on underside in ♂........ ? *viridis.*

B. Outer margin more or less convex.

  b. Hinder margin moderately convex.

      dd. Costal patch none........ . *sylvester.*

ddd. Brands two, also present on underside .... *Dardanus*

dddd. No corresponding brand marks on underside in ♀ .... *Crithon.*

C. Outer margin slightly excavated.

c. Hinder margin moderately convex.

ee. Costal patch none.

eee. Brands none .... *Boreas.*

eeee. Single white band on underside corresponding to brand mark in other species; in both sexes ? *monilifera.*

d. Hinder margin extremely convex.

ff. Costal patch none.

fff. Brand single, very large; underside brand double in ♂.

ffff. Single white band on underside corresponding to brand mark, in ♀................................ *Amycus.*

D. Outer margin decidedly excavated.

e. Hinder margin excessively convex.

gg. Costal patch none .... *Corinna.*

ggg. Brand single, small .... *Euclus.*

gggg. Single white line on underside corresponding with brand mark; both sexes .... ? *Boisduvalii.*

Genus Euplœa, *Fab.*

A. Outer margin of primaries rather convex; hinder margin in ♂ considerably convex; with colourless oval patch upper side of costa of secondaries in ♂; without sexual brands—or scent glands.

E. NIVEATA, *Butler.*

(Calliplœa N.) Trans. Ent. Soc. p. 2, 1875; Jour. Linn. Soc. Zool. XIV. p. 296, 1878.

Moore, (*Call. N.*), Proc. Zool. Soc. p. 295, 1883.

Cape York.

Butler says this is distinct from his *Hyems* = *Aerisbe*, Feld., a Timor species, although his figure of the latter seems to exactly represent the C. York species, and the description would equally suit.

E. TULLIOLUS, *Fab.*

(Pap. T.) Ent. Syst. III. 1, p. 41, n. 103, 1793; *Godart (Dan. T.)*, Enc. Méth. IX. p. 181, 1819; *Don.* Nat. Rep. II. t. 55, f. 1, 1824; *Macleay*, King's Aust. II. p. 461, 1827; *Doubl. and Hew.*, Gen. D. Lep. p. 88, n. 26, 1847; *Butler*, Proc. Zool. Soc. p. 290, n. 64, 1866; *(Call. T.)* Jour. Linn. Soc. Zool. XIV. p. 296, 1878; *Semper*, Mus. Godff. XIV. Lep. p. 142, 1878; *Moore (Call. T.)* Proc. Zool. Soc. p. 295, 1883; var *a. E. Saundersii, Feld.* Reise Nov. Lep. II. p. 322, n. 439, 1867.

Rockhampton, northwards to Cape York; also from Fiji.

E. DARCHIA, *Macleay.*

(Dan. D.) King's Australia II., p. 462, n. 149, 1827; *Butler*, Jour. Linn. Soc. Zool. XIV. p. 296, 1878; *Moore (Call. D.)*, Proc. Zool. Soc. p. 295, 1883; *E. Priapus, Butler*, Proc. Zool. Soc. p. 291, n. 67, t. 29, f. 2, 1866; Trans. Ent. Soc. p. 2, 1875; *(Call. P.)* Jour. Linn. Soc. Zool. XIV. p. 296, 1878; *Moore (Call. P.)*, Proc. Zool. Soc. p. 295, 1883.

Port Essington.

I only know this species by description, but it must belong to this group.

Without costal patch, and without sexual brands.

E. MISENUS, n.sp.

♂. UPPERSIDE.—*Primaries:* Dense velvety opaque brownish-black, without markings of any kind. *Secondaries:* Dark brown

with a silky gloss, except anal region, which is light brown, increasing in darkness towards base and discal area; from anal angle towards apex a sub-marginal row of faintly discernible small pale spots.

UNDERSIDE.—Light shining brown, darker in discal area. *Primaries* with a bluish speck within and near end of cell, and another just outside. *Secondaries*, a small bluish spot within and at end of cell, and a series of five white small spots transversely beyond cell; a few outer sub-marginal white points from anal angle.

Thorax and abdomen, above black; beneath, dark brown.

Exp. $3\frac{5}{12}$ in.

Hab.—Cape York. Coll. Miskin.

This is probably the insect that Semper (Mus. Godff. p. 6) refers to, *Climena*, Cr., which it certainly very much resembles, but is, I think, sufficiently distinct.

With costal patch on secondaries of ♂; and a single brand, oval-shaped, also present on underside in ♂.

E. HIPPIAS, n.sp.

♂. UPPERSIDE.—*Primaries:* Rusty brown; centre of wing from just beyond base, where it commences narrowly, increasing in width outwardly, embracing lower part of cell and below last median branch, and extending outwardly to a short distance from middle of outer border, is a patch of very pale brown, growing lighter in shade, until at the extremity it is a yellowish-white. *Secondaries*, rust-brown, with a large oval-shaped patch of ochreous-brown occupying about one-half the cell and extending upwards towards costa.

UNDERSIDE.—*Primaries* as above; *secondaries* all smoke-brown, without markings of any kind.

Thorax and abdomen, above dark brown; beneath light brown.

Exp. $3\frac{3}{12}$ in.

Hab.—Cape York. Coll. Miskin.

E. VIRIDIS, *Butler*.

(Salpinx V.) Ann. Nat. Hist. (5) X, p. 38, ♀, 1882; *Moore (Saphara V.)*, Proc. Zool. Soc. p. 298, 1883.

Thursday Island.

I have not seen a specimen of this insect; it will probably come under this group.

B. Outer margin more or less convex; hinder margin moderately convex; costal patch none; brands two, also present on underside; no corresponding brand marks on underside of ♀.

E. SYLVESTER, *Fab.*

(Pap. S.) Ent. Syst. III. 1, p. 41, n. 104, 1793; *Don.* Nat. Rep. IV. t. 129, 1826; *Doubl. and Hew.*, Gen. D. L. p. 88, n. 25, 1847; *Butler*, Proc. Zool. Soc. p. 290, 1866; *Westw.*, Trans. Ent. Soc. p. 108, 1872; *Semper*, Mus. Godff. p. 6, n. 7, 1878; *Stictop. S.*, *Butler*, Jour. Linn. Soc. Zool. XIV. p. 303, 1878; *Doricha S.*, *Moore*, Proc. Zool. Soc. p. 318, 1883; *Dan. Sylvestris*, *Godart*, Enc. Méth. IX. p. 182, n. 20, 1819; *E. Pelor*, *Doubl. and Hew.*, Gen. D. L. t. 11, f. 1, 1847; *Butler*, Proc. Zool. Soc. p. 300, n. 91, 1866; *Chenu*, Enc. D'Hist. Nat. p. 64, f. 153, 1869; *Stic. P.*, *Butler*, Jour. Linn. Soc. Zool. XIV. p. 303, 1878; *Dor. P.*, *Moore*, Proc. Zool. Soc. p. 318, 1883; *E. Melpomene*, *Butler*, Proc. Zool. Soc., p. 300, n. 92, p. 298, f. 2, 1866.

Bowen to Cape York.

E. DARDANUS, n.sp.

♂. UPPERSIDE.—*Primaries:* Velvety dense brownish-black, with slight purple reflection: a series of three bluish-white spots across and near to apex, the central much the largest, the lower a mere speck; two other round similar spots close to outer margin below the middle. *Secondaries*: Soft dark brown, much darker towards the base; a sub-marginal band of eight dirty white spots, of which the two central are double, the three towards apical angle round, the anal three elongate; all the spots are ill-defined on their inner margin, softening gradually into the brown.

UNDERSIDE.—Light brown, the discal and basal areas much darker. *Primaries* with the spots as above, and in addition one small spot above and one below the apical series; four small blue spots in centre of wing, one being within and near to end of cell, and three transversely just beyond and below cell. *Secondaries* with the spots of sub-marginal band rather more defined; a discal group of blue specks, one within, five others encircling end of cell.

Thorax and abdomen black.

Exp. 3 in.

Hab.—Cape York. Coll. Miskin.

This species is near to *sylvester*, but is distinguished from it particularly by the absence of marginal rows of white specks in both wings.

E. CRITHON, n.sp.

♂. UPPERSIDE.—Dense velvety black with purple reflection, without mark of any kind.

UNDERSIDE.—Basal and discal areas dark brown, outer area light brown. *Primaries* with two blue-white small spots between 1st and 2nd, and 2nd and 3rd median branches, near end of cell. *Secondaries* with five small violet spots arranged in a semicircle around end of cell.

Thorax and abdomen black.

Exp. 3 in.

Hab.—Cape York. Coll. Miskin.

C. Outer margin slightly excavated; hinder margin moderately convex; costal patch none; brands none; single white band on underside corresponding to brand mark in other species; in both sexes.

E. BOREAS, n.sp.

♂. UPPERSIDE.—*Primaries:* Dense opaque brown, with an arched apical band of five white spots; an outer complete marginal row of white specks; two small white spots within marginal row, just below middle. *Secondaries:* Dark brown with silken gloss; perfect outer marginal row of small white spots not quite reaching anal angle; a transverse band of white patches from anal angle, where they are largest, to apical angle, the two last being round and smaller, the others double and elongate; abdominal margin rusty brown.

UNDERSIDE.—Light shining brown; discal area darker; with spots as above, but rather more developed, and with some additional ones in primaries; one in and near end of cell, and six others arranged transversely around end of cell, these having a bluish tinge. *Secondaries* also as above, with a curved series of five small bluish-white specks encircling end of cell, and one within.

♀. Similar to ♂, but lighter brown and without gloss; the white markings somewhat more developed, and with an additional white spot situated upon the costa rather beyond middle, above and beneath, and three additional ones in the discal series.

Thorax and abdomen dark brown.

Exp. $2\frac{11}{12}$ to $3\frac{2}{12}$ in.

Hab.—Cardwell. Coll. Miskin.

E. MONILIFERA, *Moore.*

(Gamatoba M.) Proc. Zool. Soc. p. 262, 1883.

Thursday Island.

I only know this species by the description; it appears to come under this group.

Hinder margin excessively convex; costal patch none; brand single, very large; underside, brand double in ♂; single white band on underside of ♀ corresponding to brand mark.

E. AMYCUS, n.sp.

♂. UPPERSIDE.—*Primaries:* Dark velvety brown, outer area lighter; apical band of four irregularly-shaped clouded white spots, the two upper being the smallest; a small round white spot between 1st and 2nd median branches near outer margin. *Secondaries:* Base and discal area dark brown, rest of wing light brown; two small white sub-marginal spots near apex, lower one almost obsolete.

UNDERSIDE.—Smoky brown, marked with bluish-white small spots, except apical ones, which are white. *Primaries*, an apical band of five spots; one within and near end of cell; three transversely below and beyond end of cell; hind margin very pale. *Secondaries*, three outer sub-marginal double spots near apex; one within end of cell; six in a semicircle around end of cell; costa with a rufous tinge.

♀ as in ♂, but somewhat paler, and with the spots rather less distinct.

Thorax and abdomen dark brown.

Exp. $2\frac{10}{12}$-$3\frac{2}{12}$ in.

Hab.—Cape York. Coll. Miskin.

D. Outer margin decidedly excavated; hinder margin excessively convex; costal patch none; brand single, small; single white line on underside both sexes, corresponding with brand mark.

E. CORINNA, *Macleay.*

(Dan. C.) King's Aust. II. p. 462, n. 150, 1827; *Butler*, Jour. Linn. Soc. Zool. XIV. p. 299, 1878; *Moore* (*Charapa C.*), Proc. Zool. Soc. p. 270, 1883; *E. Angasii*, *Felder*, Reise Nov. Lep. II. p. 343, n. 476, 1867; *Herr.-Schf.*, Stett. Ent. Zeit. p. 69, t. 2, f. 7, 1869; Ex. Schmett. II. f. 108, ♂, 1869; *Semper*, Mus. Godff.

XIV, p. 141, 1879; *Moore* (*Chanapa A.*), Proc. Zool. Soc. p. 270, 1883; *E. Lewinii*, *Felder*, Reise Nov. Lep. II. p. 345, n. 478, 1867; *Moore (Ch. L.)*, Proc. Zool. Soc. p. 270, 1883.

Brisbane to Cape York.

This species is exceedingly common in southern Queensland, but seems to get scarcer as we proceed north, where its place is taken by *Tulliolus* at Rockhampton, a very abundant species there; and by *sylvester*, still further north, which is found in equal abundance in its more particular locality.

E. EUCLUS, n.sp.

♂. UPPERSIDE.—Chocolate brown, with yellowish-white spots. *Primaries*, a small sub-costal spot above middle; a series of six spots in an arched row across apex, three being pretty close to costa and very small, the two next large, the last small and near outer border; two spots near to and about middle of outer margin, the upper being the larger and further from border. *Secondaries* with a transverse band parallel to, but some little distance in from, outer margin, of elongate narrow spots in pairs between the nervules, except the upper three, which are round.

UNDERSIDE.—Light shining brown, discal areas purplish-brown, spots in discal areas being bluish-white, other markings yellowish-white. *Primaries* with markings as above, and in addition a diseal spot and a transverse row outside of this of six small spots; a few sub-marginal specks. *Secondaries*: a transverse band as above; a discal speck, and a curved series around end of cell of seven small spots; a complete sub-marginal row of white specks.

♀. As in ♂, but a shade lighter; a third spot upperside of primaries near hinder angle; the band in secondaries less developed.

UNDERSIDE as in ♂, showing the sub-marginal row of white specks in primaries more developed, and three spots instead of two towards hinder angle, the upper one being very large and round.

Thorax and abdomen dark brown.

Exp. ♂ 3 in., ♀ $3\frac{2}{12}$ in.

Hab.—Cape York. Coll. Miskin.

This species is very close to *Corinna*, but is pretty well distinguished on the upperside by the absence of sub-marginal row of white spots in both wings, and by the less developed transverse band of secondaries. On the underside the resemblance is somewhat close, but, as the latter is very stable in its appearance, I think this species must be considered as distinct.

E. BOISDUVALII, *Lucas.*

Rev. Zool. p. 321, 1853; *Butler*, Proc. Zool. Soc. p. 302, n. 90, 1866; *Moore (Deragena B.)*, Proc. Zool. Soc. p. 272, 1883.

Australia.

I cannot identify this species with any form known to me. I assume it to belong to this group from the description.

E. EICHORNI, *Staudinger.*

Ex. Schmett. p. 53, T. XXVI. 1885?

N. Queensland.

I am unable to refer to description and figure of this species. I cannot therefore place it in any of my groups.

The following species are mentioned as Australian, I think erroneously:—

E. eleutho, Quoy; E. eschscholtzii, Felder; E. climena, Cramer; E. eleusina, Cramer.

ON CEDAR GUM (*CEDRELA AUSTRALIS*, F.v.M.).

By J. H. Maiden, F.L.S., F.C.S.

The well-known "Cedar" or "Red Cedar" of New South Wales and Queensland is the produce of a *Cedrela*, but in regard to the species there is a difference of opinion. Bentham (B.Fl. I. 387) considers it to be identical with *C. Toona*, Roxb., the Indian Toon Tree, which produces " Moulmein Cedar " and one of the " Chittagong woods." Baron von Mueller, on the other hand, created a new species for it (*C. australis*, F.v.M.). It is very certain the affinities of the two trees are very close, and it becomes interesting to see if examination of any of their products tends to throw any light on the subject.

The writer is not aware that the finding of gum on the New South Wales Cedar has hitherto been recorded, but a collector sent to the Technological Museum a small quantity recently. An old cedar-getter says that trees well exposed to the sun (? in unsuitable situations) yield most gum.

It is a very pale yellow gum, almost colourless, and in thin tears about an inch long. Between the teeth it almost feels leathery. It swells up largely in cold water, but in the course of twenty-four hours it nearly wholly dissolves, forming a solution colourless and faintly cloudy, like good gum arabic, and leaving a small percentage of metarabin.

It is one of the gums which form a connecting link between the Arabin group,—those gums which dissolve almost immediately in water, and the Metarabin group,—those which merely swell up in that liquid. It forms a fair mucilage, and on account of its freedom from colour it would be a valuable commodity if obtainable in any quantity. An analysis gave the following result:—

Arabin	68·3
Metarabin	6·3
Hygroscopic moisture	19·54
Ash	5·16

Here we have a true gum, without so much as a trace of resin.

Following is the evidence the author has been able to collect in regard to the exudation of the Indian tree.

"It yields a *resinous* gum" *(Cat. Kew Museums).* Perhaps the experiments of von Essenbeck *(infra)* are the foundation for this statement.

"It is called bastard cedar from an aromatic *(sic) resin* exuding from it, resembling that of the American Cedar" (Art. *Cedrela Toona* in Surgeon-General Balfour's *Cyclop. of India*). No definite authority is given for this statement, and the writer is probably labouring under a misapprehension, as the name Cedar was bestowed in reference to the wood, and not to any exudation.

The experiments of Nees von Essenbeck, who *extracted from the bark* a *resinous* astringent matter, and a brown astringent *gum*, do not affect the point at issue one way or the other.

"Toon-ke-gond" *(C. Toona)* is enumerated by Dr. Wight as one of the *gums* of Coimbatore. Yet Cooke *(Gums and Resins of India)* who quotes this statement, says, "From the character of the timber one might suppose it rather a resin than a gum." I am not impressed with the force of the latter observation.

A sample of "Toon-ke-gond," the exudation of *C. Toona*, was exhibited by Dr. Royle at the Exhibition of 1851 (No. 52, p. 180, Jury Reports). It is not definitely stated whether it is a gum or a resin, and there is nothing in the context to clear up the point absolutely.

Dragendorff *(Pflanzenanalyze,* Greenish's Trans. p. 212) speaks of "the partially soluble *gum* of species of . . . *Cedrela.*" To

this specific statement of a man who only employs the term "gum" in its proper significance, I attach much importance.

I consider the balance of probability to be largely in favour of the exudation in the Indian species being a gum and not a resin. As collateral evidence, the exudations from the Indian *Melia Azadirachta*, Linn., (another of the "Chittagong woods"), and the Australian form of *M. Azedarach*, Linn., may be instanced together with the Spotted or Leopard-tree gum (*Flindersia maculosa*). These are the only other exudations of the *Meliaceæ* recorded as far as I know. I have seen and examined them, and they are true *gums*.

ON THE NIDIFICATION OF *HETEROMYIAS CINEREIFRONS*, RAMSAY, AND *ORTHONYX SPALDINGI*, RAMSAY.

BY A. J. NORTH, F.L.S.

The Trustees of the Australian Museum have recently received from their collectors, Messrs. Cairn and Grant, specimens of the nests and eggs of *Heteromyias cinereifrons*, and *Orthonyx spaldingi*, from North-eastern Queensland, which with the sanction of the Curator I am here permitted to describe.

HETEROMYIAS CINEREIFRONS, *Ramsay*. Ashy-fronted Flycatcher.

" *Win-dan*," Aborigines of Cairns district.

During September and October of this year several nests of this species were obtained by Messrs. Cairn and Grant, in the scrubs of the Herberton tableland; in every instance they were found in the "Lawyer vines" (*Calamus* sp.), about four or five feet from the ground; several of these nests now before me have been built between the forked stems, or where several vines cross each other, in other instances they have been placed on the thin horizontal stems to which the nests are attached. The outside of the nest is formed of thin twigs bent into shape, wiry rootlets, skeletons of leaves, and the fibre of the "Lawyer vine;" the inside which is saucer-shaped, being neatly lined with finer materials, while the exterior portion of the nest is ornamented with mosses and lichens, which give it a pleasing appearance. Exterior diameter 4·5 inches, depth 4; internal diameter 2·75, depth 1·1. The eggs are two in number for a sitting and closely resemble in shape and colour large specimens of *Artamus superciliosus*, being of a dull buffy white ground colour, thickly covered, especially towards the larger end, with clouded markings of umber brown;

in some instances they are more clearly defined and boldly blotched, and have markings of deep bluish-grey appearing as if beneath the surface of the shell. A set taken on the 18th of September measures as follows:—Length (A.) 1·05 × 0.75 inch; (B.) 1·07 × 0·77.

ORTHONYX SPALDINGI, *Ramsay*. Spalding's Orthonyx.

"*Chowchilla*," Aborigines of Cairns District.

This species has recently been met with rather freely dispersed through the dense brushes of the coastal range, chiefly in the neighbourhood of the Mulgrave and Russell Rivers, in North-eastern Queensland. Mr. Cairn who found several nests of this species, states they are usually built in the tangled roots of "Lawyer vines," but not unfrequently on the top of a stag-horn fern, as high as twelve feet from the ground. The nest is a large bulky dome-shaped structure with an entrance on one side; it is composed of twigs, roots, and mosses, chiefly species of *Hypnum*, so loosely put together that it will not bear removal. Unlike its southern ally *O. spinicaudus*, it appears that only one egg is laid for a sitting. A nest found on the table land near Boar Pocket, on the 20th of June last, contained but one egg in an advanced state of incubation; others were found as late as the middle of August. The breeding season this year would appear to be from May till the end of September, young birds being procured in June, but as in other parts of Australia the breeding season of birds is greatly influenced by the rains.

The eggs which are pure white, vary from elongated to swollen ovals, some being equal in size at each end. Two average-sized specimens measure (A.) 1·45 inch × 1, (B.) 1·38 × 1·1.

NOTES AND EXHIBITS.

Professor Stephens exhibited, for Mr. M'Cooey, an Albino variety of *Dacelo gigas*, and read a lengthy note on the habits of the bird. Also, for the same gentleman, the head of a specimen of *Diemenia superciliosa* with two poison fangs in the right jaw.

Dr. Ramsay exhibited a specimen of *Dendrolagus Lumholtzi* from Mt. Bartle Frere, Northern Queensland. Also a rare Bird of Paradise (*Diphyllodes Gulielmi* III. ♂), from New Guinea. Also specimens of a bower bird (*Prionodura Newtoniana*), ♂, ♀, and young ♂; and *Sericornis gutturalis*, ♂, ♀, and young ♂, from Mt. Bartle Frere, recently obtained by Messrs. Cairn and Grant, collectors for the Trustees of the Australian Museum.

Mr. North exhibited the nests and eggs described in his paper.

Mr. Skuse exhibited several specimens of the adults and pupa-cases of a species of *Tachina*, a Dipterous parasite of the larvæ of the common case-moth, *Oiketicus elongatus*, Saund. About seventy flies were reared from a single host. Also, specimens of *Icerya purchasi*, Mask., or the Cottony-cushion Scale, which he had recently found in large numbers infesting the Desert Cypress, or hill-pine [*Frenela Endlicheri* (?)], on the Mallabo range, near Wagga Wagga, N.S.W., which seems to strongly support the belief that this insect is indigenous in Australia. Also, several galls of Cecidomyidæ, from some of which Mr. Froggatt and himself had bred the perfect insects.

Mr. A. Sidney Olliff called attention to the phenomenal abundance of a large Noctuid Moth—apparently *Agrotis spina*, Gu., (*A. vastator*, Sc.)—during the early part of the present month in various parts of the country, especially in the vicinity of Sydney, where it appeared in such vast numbers as to cause great consternation amongst

those who are not aware that its food in the larval state is confined to low-growing herbage, and that at no stage of its existence does it eat cloth, furs, or feathers. A similar visitation of these moths occurred in October, 1867, which is recorded by Mr. A. W. Scott in an interesting paper in the Transactions of the Entomological Society of New South Wales (Vol. II. pp. 40-48), and by the Rev. W. B. Clarke in a letter in the "Sydney Morning Herald" of the 11th October, 1867. From these sources it may be gathered that the recent plague was identical in its details with that of 1867, inasmuch as the present visitation appears to be confined to the country on the sea-board side of the coast-range, and to be the result of the vast hordes of caterpillars, reports of whose appearances in various places have reached us from time to time during August and September. Mr. Olliff said that *Agrotis spina* was found in great numbers on the summit of Mount Kosciusko and other high points in the Australian Alps, and added that he was of opinion, after extended inquiry, that this species and no other was the true Bugong Moth, which formerly formed an important article of food amongst the blacks of the Upper Tumut district; the reasons for this opinion he hoped to place before the Society upon some future occasion.

Mr. Kershaw related his experiences of similar swarms of the same moth in Gippsland and at Western Port, Victoria.

Mr. Froggatt exhibited eight different kinds of galls, obtained chiefly in the neighbourhood of Rose Bay and Woollahra, together with the insects bred from them, and made the following remarks:—"No. 1 is a very common gall on the stems of *Acacia discolor*, but is usually so infested with parasitic Hymenoptera (Fam. *Chalcididæ*) that out of some fifty galls the true makers (Fam. *Cynipidæ*) were obtained in only four instances; No. 2 is a very small gall occurring in numbers on both sides of the leaves of *Eucalyptus corymbosa* in the form of small rust-red excrescences, each of which contains from two to four gall-makers (Fam. *Cynipidæ*), but as many parasites (Fam. *Chalcididæ*)

are obtainable from them; No. 3 is a gall occurring generally on the midrib of the leaves of *E. corymbosa*, out of which only beautiful little wasps with black markings (Fam. *Proctotrupidæ*) were obtained; No. 4 is a curious gall occurring also on *E. corymbosa*, from which a small *Cecidomyia*—probably the true gall-maker—together with parasites (Fam. *Chalcididæ*) were bred; No. 5 is an irregularly shaped gall occurring generally at the base of the leaves of *E. corymbosa*, from which only parasitic Hymenoptera (Fam. *Chalcididæ*) were obtained; No. 6 is a gall forming swellings on the twigs of *E. corymbosa*, from which only parasitic Hymenoptera (Fam. *Chalcididæ*) were obtained; No. 7 is the horned coccus gall (*Brachyscelis munita*, Sch.) from the horns of which parasites (Fam. *Chalcididæ*) emerged; No. 8 are oval coccus galls (*Brachyscelis pileata*, Sch.) from Port Hacking, from which Hymenoptera (Fam. *Proctotrupidæ* and *Chalcididæ*) together with two moths emerged."

Mr. Maiden exhibited a quantity of the gum of the Red Cedar described in his paper. Also a large collection (about 880 species) of European plants, which he then presented to the Society.

A vote of thanks was accorded to Mr. Maiden for his valuable present.

Mr. Fletcher exhibited a collection of sixty species of plants from the neighbourhood of Hay, N.S.W., a fairly representative sample of the luxuriant vegetation of the Murrumbidgee plains in the present almost unprecedentedly favourable season, during which the plains have been a magnificent natural flower-garden on a gigantic scale, whereas in the same month (September) of the preceding dry year they were entirely bare. Dr. Woolls, who has kindly examined the collection, states that he was struck with the unusual proportions of some of the plants, both leaves and flowers being larger than those of the typical plants described in the *Flora Australiensis*.

Mr. Fletcher also exhibited a small collection of plants sent by Captain Hoben, of North Peak Station, Nymagee, gathered on the station, which is situated between Nymagee and Mt. Hope, N.S.W. Also for Mr. Bolton, of Wagga Wagga, (1) specimens of an undetermined plant* which has made its appearance in one particular locality in the district, and respecting which, especially as regards its suitability or otherwise as a forage plant, information was sought; and (2) specimens of trefoil, and of a supposed hybrid (?) between this and clover.

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* Subsequently ascertained to be *Silene cucubalus*, Wibel, (*S. inflata* Sm.), given in Baron von Mueller's list of Victorian introduced plants, but not previously recorded from N.S.W. The other two plants exhibited were *Medicago denticulata*, Willd., and *Trifolium glomeratum*, Willd., both introduced.

WEDNESDAY, 27TH NOVEMBER, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

Dr. Schewiakoff, Dr. Lauterbach, and Mr. Alexander Morton of Hobart were present as visitors.

DONATIONS.

"Report of the Board of Governors of the Public Library, Museum, and Art Gallery of South Australia, with the Reports of the Standing Committees for 1888-9." *From the General Director and Secretary.*

"Report of the Trustees of the Public Library, Museums, and National Gallery of Victoria for 1888, &c." *From the Librarian.*

"Feuille des Jeunes Naturalistes." No. 228 (October, 1889). *From the Editor.*

"The Victorian Naturalist." Vol. VI., No. 7 (November, 1889); "Ninth Annual Report, 1888-9, List of Members, &c." *From the Field Naturalists' Club of Victoria.*

"Comité Géologique, St. Pétersbourg.—Mémoires." Tome III., No. 4; VIII., No. 1 (1888-9); "Bulletins." T. VII., Nos. 6-10; VIII., Nos. 1-5 (1888-9); "Supplément au T. VIII." *From the Committee.*

"Bulletins de l'Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgique." 3me Série. Tomes XIV.-XVII. (1887-89); "Annuaire." 1888 and 1889. *From the Academy.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 317 & 318 (1889). *From the Editor.*

"Report of the Committee of Management of the Technological, Industrial, and Sanitary Museum of New South Wales, for 1888." *From the Curator.*

"Bulletin of the American Geographical Society." Vol. XXI., No. 3 (1889). *From the Society.*

"The American Naturalist." Vol. XXIII., No. 269 (May, 1889). *From the Editors.*

"Proceedings of the United States National Museum." Vol. XI. (1888), Sheets 36-42, plates 41-60. *From the Museum.*

"Abstract of Proceedings of the Royal Society of Tasmania, 15th October, 1889"; "President's Address, Nov. 18th, 1889." *From the Society.*

"Research into the Pharmacology of some Queensland Plants, &c." By T. L. Bancroft, M.B. *From the Author.*

"Reichenbachia.—Orchids Illustrated and Described by F. Sander, &c." Vol. II., Part 7 (1889). *From Sir W. Macleay, F.L.S. &c.*

"Proceedings of the Zoological Society of London for the year 1889." Part II. *From the Society.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CIX., Nos. 8-11 (1889). *From the Academy.*

"Victoria.—Second and Third Progress Reports of Royal Commission to inquire into and report upon the Sanitary Condition of Melbourne." *From the Commission.*

"Journal of the Royal Microscopical Society, London, 1889." Part 4. *From the Society.*

"Bulletin de la Société Belge de Microscopie." XV. Année, Nos. VIII.-X. (1889). *From the Society.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 47 (Nov., 1889). *From the Editor.*

"Prodromus of the Zoology of Victoria." Decade XIX. By Frederick McCoy, C.M.G., M.A., &c. *From the Premier of Victoria, through the Librarian, Public Library, Melbourne.*

NOTE ON THE BREEDING OF THE GLOSSY IBIS, *FALCINELLUS IGNEUS (IBIS FALCINELLUS*, LINN.).

BY K. H. BENNETT, F.L.S.

As I have never heard of an instance of this bird breeding here before, nor seen a description of its nest or eggs, perhaps a short account may be of interest to my ornithological fellow members.

I will premise my remarks by stating that the present year in this part of the country (Lower Lachlan) has been an unprecedently wet one, surpassing in this respect the far-famed 1870. In consequence of this unusual rainfall large bodies of water have collected, exceeding anything previously seen by white men; and this doubtless has been the cause of the present bird, as well as several other aquatic species, breeding here this year that I had not known to do so previously; whilst birds that I had never seen here before,—though they did not breed—were amongst the visitants.

Some years ago I described in the Proceedings of the Society the breeding place of *Platalea flavipes*, Gould, and *Ardea pacifica*, Lath., which is situated in a large depression on the plain, and, for the greater part of its extent thickly overgrown with "Box" *(Eucalyptus)* trees, a few miles from Yandembah Station. In consequence of the great rainfall of the past few months, this hollow is now full of water reaching up to the lower branches of many of the trees, in fact quite a lake.

Wishing to obtain some spoonbill and herons' eggs I visited this place on the 22nd of October, and swam into the part of the hollow where the heronry is situated. Whilst swimming about I noticed a glossy ibis fly off a nest on the branch of a tree some eight or ten feet above the water, but having no idea that this bird bred here, I did not take much notice of the circumstance thinking that

the bird was merely perched there; but I remarked that the nest appeared recently constructed, and differed entirely from the scores of nests of many species of birds surrounding me. After obtaining a number of spoonbills' and other eggs I was returning to land, and in doing so again passed the same tree, and the ibis again flew off the nest. This aroused my interest, and I at once swam to and ascended the tree, and found that the nest contained one egg of a beautiful greenish-blue colour, somewhat resembling that of *Ardea novæ-hollandiæ*, but much brighter; this egg I took but unfortunately broke it whilst returning to land. The nest was placed in an upright three-pronged fork of a small tree, and was entirely composed of branches of box (*Eucalyptus*) leaves, built up to about a foot in height, slightly hollowed on the top, and without any lining beyond the leaves of which it was composed.

Thinking it probable that I might find other nests of this bird in this large and secluded swamp or lake, I again visited it on the 2nd of the present month (November), and when swimming up to the tree from which I had taken the egg on my previous visit, I saw the ibis to my surprise and gratification again fly off the nest, which on examination contained three beautiful eggs. A further search amongst the thickly growing trees resulted in the discovery of another nest which also contained three eggs, but these were so very much larger than the previous ones that had I not seen the bird on and fly off the nest, I should have considered them as belonging to some other species; but there is no possible doubt as to their identity, for, owing to incubation having begun, the bird was very reluctant to leave the nest, and let me approach almost to arm's length before she did so. This nest was exactly similar to the preceding one in material and structure, and placed in a similar position.

PRELIMINARY NOTES ON THE PHARMACOLOGY OF SOME NEW POISONOUS PLANTS.

By Thos. L. Bancroft, M.B., Edin.

(Communicated by J. H. Maiden, F.L.S.)

Laurelia Novæ-Zelandiæ, A. Cunn., N.O. Monimiaceæ.

In a bush at Waipu, province of Auckland, N.Z., June 1887, whilst in search of poisonous plants, I found the bark of the tree called by the Maoris "Pukatea" had a rather agreeable aromatic bitter taste, a little of which was gathered for experiment.

Whilst at Christchurch some months later opportunity presented itself of investigating the physiological action of this and several other plants.

An alcoholic extract was made, which when injected into frogs, "the introduced frog from Australia, *Litoria aurea*," caused rapid death. A few spasmodic jerks of the hind limbs were noticed before the animal became flaccid. The muscles, motor nerves, and heart were apparently uninfluenced. A solution of the extract in water gave the reactions of an alkaloid.

Mr. Cheeseman of the Auckland Museum kindly told me the scientific name of the plant. There is only one other known species of *Laurelia* and that is indigenous to Chili.

Laurelia is related closely to the genera *Atherosperma* and *Daphnandra*, all the species of which genera possess active properties.

Myoporum lætum, Forst., N.O., Myoporineæ.

Preparations of this plant are poisonous to frogs. The bark contains an oil and a wax; whether or not any other substance I did not decide. The oil, at any rate, is poisonous to frogs.

Melicytus ramiflorus, Forst., N.O. Violarieæ.

This is a small tree with a peculiar tasting bark. An extract of it is slightly poisonous to frogs, and causes in them a good deal of secretion of the skin.

VERONICA SALICIFOLIA, Forst. DYSOXYLUM SPECTABILE, Hook. GENIOSTOMA LIGUSTRIFOLIUM, A. Cunn. SOPHORA TETRAPTERA, Aiton.	Also New Zealand plants were examined but found inert.

MARLEA VITIENSIS, Benth., N.O. Cornaceæ.

In May, 1888, through the courtesy of Messrs. F. M. Bailey and Carl Madsen, I had an opportunity to examine the Queensland collection of woods prepared for the Melbourne Exhibition.

A dozen or more bitter barks, not previously known, were found, but only that of *Marlea vitiensis* proved to be poisonous.

Preparations of this plant apparently kill frogs by bringing the heart to a standstill in diastole. Motor nerves and muscles are unaffected if death takes place rapidly, but if delayed they are found in a state of paralysis. This paralysis is due, in part at any rate, to stasis of blood circulation, for the heart beats very feebly from an early period of the poisoning. Vomiting is a remarkable symptom.

Frogs when poisoned with this substance become less irritable to a stimulus of any kind. The active principle is an alkaloid, easy of preparation. It is insoluble in chloroform, ether, benzine and turpentine, slightly soluble in water and in aqueous alcohol.

So far I have not been successful in getting it or any of its salts in a crystalline form.

It appears not to be emetine, although it probably belongs to the group of poisons of which emetine is the type.

LUFFA ÆGYPTIACA, Mill., N.O. Cucurbitaceæ.

This plant is a native of Northern Queensland, and was pointed out to me by Mr. Bailey as possessing an extremely bitter fruit.

Upon tasting the fruit there is experienced an intensely bitter sensation, which in a few minutes disappears but leaves a distressing acridity in the throat, which is not at its worst until several hours afterwards.

An extract is very poisonous and contains two principles, a bitter substance and a saponin.

Papaver horridum, DC., N.O. Papaveraceæ.

I have for some years past been anxious to ascertain whether the native poppy contained morphine, but it was not until last August that I was enabled, through the kindness of Mr. J. H. Simmonds, to obtain a supply of the plant.

All parts of the plant have a slightly bitter acrid taste. An extract is very poisonous to frogs, *Hyla cærulea*, *Chiroleptes australis*, and *Limnodynastes salminii*, but in none of these frogs are there any tetanic spasms developed. *Hylas* develop tetanus after poisoning with morphine. I endeavoured to prepare morphine from an extract of this plant according to the method prescribed by the British Pharmacopœia, but failed to get even a trace of that substance, or indeed of any other substance. Judging from this and from the physiological effect on frogs it would appear that the active principle is not morphine. It is, however, quite as poisonous as morphine.

I have to thank Mr. Chas. De Vis, M.A., for the scientific names of the frogs.

Solanum verbascifolium, Ait., N.O. Solanaceæ.

A large shrub, often twenty feet high, with a bitter bark. An extract of the bark is only slightly poisonous to frogs.

An alkaloid can be prepared in a pure state from this plant in the following manner. Pulverise the bark, exhaust by boiling aqueous alcohol, distil off the alcohol, dissolve the extract in water, filter, precipitate with carbonate of soda. It seems to be insoluble in ether and chloroform, but very soluble in alcohol. It is not mydriatic. In these particulars it agrees with Solanine.*

Stephania hernandiæfolia, Walp., N.O. Menispermaceæ.

The root of this plant is bitter. An extract of it is extremely poisonous to frogs. These animals are affected by it in a most remarkable manner. After they have had the poison injected into a lymph-sac, they remain perfectly quiet until suddenly they are attacked with violent convulsions, which last one or two

* Since the above was written I have discovered that Solanine has been found in the fruit of this plant. (Wittstein's Organic Constituents of Plants, translated by Baron von Mueller, pp. 204 and 257.)

minutes, after which they become flaccid and have spasmodic contractions of all the limbs every moment or so, the contractions getting weaker and weaker until they cease. The heart continues to beat regularly for many hours and stops in full diastole.

There is a great increase of secretion of the skin.

Frogs that have had less than a lethal dose become very irritable; there is a marked increase of reflex excitability. It is difficult, however, to make them jump; when one does so it lands upon its belly and this causes a spasm. There is a loss of co-ordination of muscular movement.

If the brain of a frog be destroyed previous to poisoning with this substance, some convulsions appear but they are not of so violent a kind as when the brain is intact.

The physiological action of this substance appears identical with that of picrotoxin, the active principle of *Cocculus*, a genus of the same order as *Stephania.*

As picrotoxin is an easy substance to separate I shall ascertain whether it is present in this plant, and add the result of the chemical investigation as this paper passes through the press.

Note.—I failed to obtain picrotoxin from this plant, but found that the active principle was a totally different substance. It appears to be an alkaloid, and may be separated in the following manner:—Bruise the rhizome in an iron mortar, macerate for several days in rectified spirit of wine, decant the tincture and allow it to evaporate. Treat the extract with water, filter, add some neutral lead acetate, digest ten minutes and set aside for several hours, filter, remove excess of lead with sulphuretted hydrogen and evaporate to a syrup, add a very little liquor potassæ, and shake out the active principle with anhydrous ether.

It is thus left as a colourless, non-crystalline substance, like bits of gum arabic. It has a peculiar smell and is bitter, neutral to litmus, slightly soluble in water but very soluble in alcohol, easily soluble in acidulated water, and the resulting salts are apparently non-crystalline; they set as varnishes.

It is exceedingly poisonous, and the symptoms produced are those of the crude extract.

ON QUEENSLAND AND OTHER AUSTRALIAN MACRO-LEPIDOPTERA, WITH LOCALITIES, AND DESCRIPTIONS OF NEW SPECIES.

By Thomas P. Lucas, M.R.C.S.E., L.S.A., L.R.C.P.Ed.

In the following paper the classification followed is that laid down in Mr. Meyrick's papers.

RHOPALOCERA.

Heteronympha affinis, n.sp.

♂♀. 45-55 mm. Head black. Palpi brown, white underneath, grey at base. Antennæ cinnamon-brown, clavelli darker, tipped with cinnamon-brown. Thorax brown, posteriorly on dorsum rich black hairs, underneath light brown. Abdomen rich brown, with freely scattered black hairs, light brown underneath. Forewings narrowly triangular, costa bowed in middle third, apex rounded, hind margin oblique, slightly wavy, rich cinnamon-brown with a deep black bordering enclosing all the ground colour spots or cells. These cells are as follows, three costal, 1st in ♀ sub-lunar, from near costa at $\frac{1}{2}$ outwardly to centre of wing—in the ♂ this is divided transversely through centre by a narrow black line, and the outer half is attenuated as a narrow curved line to near base of wing; 2nd from $\frac{2}{3}$ costa elongated diagonally for half the distance toward middle of hind margin; 3rd a rounded spot just before apex; at the inner angles of 2nd and 3rd blotches is a round mark, white in ♀, yellow-brown in ♂; between this and hind margin is a small ground colour spot, and another immediately below it; from near base to $\frac{3}{4}$ inner margin, but divided

by its own width from inner margin, is a broad rounded-off bar; and between this and dots on hind margin is a large oval blotch contracted in the centre; the basal portion of the wing and especially the costal portion is thickly covered with dark brown hairs: cilia brown and black. Hindwings, basal and inner portions dark, colour as forewings; a deep black dentated bordering from basal portion divides wing, to near apical angle of costa, into two series of brown spots or cells—the anterior or costal portion is divided by black lines into two large cells and two supplementary cells; the hind portion is divided into four helmeted cells; the innermost is small and almost obscured by adpressed dark brown hairs; the 2nd contains an ocellus, consisting of a white centre dot, a deep black ring, a narrow brown ring and a narrow black ring from within outwards; the 3rd is divided by a broad black lunular band; the 4th is simple; there is a fine submarginal black line crossed by the black bar lines dividing the margin ground colour into 5 crenulated cells; the anal one linearly elongated round anal margin; cilia brown tinted with black. In ♂ a linear ground colour line runs along costal side of inner margin band, and curves to join first costal blotch which is curved and contracts in centre at point of junction. Cells in hindwing in ♂ smaller and more obscured by diffused black-brown.

This species differs from *H. Banksii*, Leach, in its larger size, deeper colour, greater profusion of black, and in having only 7 spots instead of 10 in forewing. There is no costal bar as in *H. Banksii*. The band of black in hindwing stretches uninterruptedly across, while in *H. Banksii* it is irregular and narrower. The ocellus in *H. affinis* consists of more rings than that of *H. Banksii*.

Gippsland, Victoria.

LYCÆNIDÆ.

LYCÆNA ATTENUATA, n.sp.

♂♀. 14-17 mm. Head, thorax, and abdomen brownish-black. Palpi grey. Antennæ finely annulated, brown and white.

Forewings, costa rounded, apex rounded, hindmargin obliquely rounded, purple-blue freely dusted with grey-black scales; costal border and hindmarginal border suffused with grey-black, deeper at apex of wing, narrowed toward anal angle. Hindwings as forewings, with a well-defined narrow grey-black border round whole contour of wings semi-translucent, allowing some of the underside spots to be seen through; ♀ as ♂, but larger and more suffused with purple-blue, grey-black border deeper and better defined. Undersurface grey-white; in forewings a circular row of seven black dots, three along and near costa, four from near apex of hindmargin to near centre of wing, a small discoidal spot in centre, in hindwings there is a circular line of black dots from base to $\frac{3}{4}$ expansion of wing, three along costa, one near costa at $\frac{2}{3}$, five diagonally toward inner border at $\frac{1}{2}$, and two or three along inner border; a diffused discoidal spot in centre, and two or three spots nearer base in a line with second dot on costa; a narrow grey suffused line near hindmargin of all wings.

Mountains near coast in S.E. Queensland. Allied to *Lycæna exilis*, Luc., and *L. Lysimon*, Hüb.

A most delicate insect, and perhaps the smallest of all the Australian butterflies.

SESIADÆ.

SESIA ISOZONA, Meyr. Brisbane, Maryborough.

SESIA CHRYSOPHANES, Meyr. Bowen.

ARCTIADÆ.

EXOTROCHA LIBORIA, Cr. Brisbane.

♂. CALAMIDIA SALPINCTIS, Meyr. Brisbane; and

♀. CALAMIDIA HIRTA, Meyr.—are doubtless, as Meyrick conjectured, one species. I obtained both sexes at Moe in Gippsland, Victoria, and at passion fruit flowers in Brisbane.

SCOLIACMA BICOLOR, Boisd. Brisbane, Drouin; Gippsland, Melbourne.

SCOLIACMA ORTHOTOMA, Meyr. Brisbane; Frankstone, near Melbourne.

SCOLIACMA IRIDESCENS, n.sp.

♂♀. 20-22 mm. Head, palpi, antennæ and thorax cinnamon-brown. Abdomen grey mixed with cinnamon-brown. Forewings elongate, dilated, cinnamon-brown, irrorated with suffusions of purplish-brown, costa arched, hindmargin rounded; a suffusion of purplish-brown on costa from $\frac{1}{5}$ to $\frac{1}{2}$, narrowly so along apical angle, and broadly so on inner margin from $\frac{1}{5}$ to $\frac{2}{3}$ for one-third the width of the wing: cilia brownish-grey. Hindwings light ochreous brown, lightly clouded with scattered smoky-grey; cilia ochreous-brown. Under surface of forewing in centre, and of hindwings overlapped by forewings, dark smoky-brown, almost black.

Brisbane, in deep scrub; rare. Allied to *S. cervina*, from which it differs in its iridescent colouring, and in the scant and lighter smoky colouring of under side of wings.

SCOLIACMA CERVINA, n.sp.

♂♀. 20-22 mm. Head, palpi, antennæ, thorax and abdomen fawn colour. Legs light brown. Forewings elongate, costa gently rounded, hindmargin very obliquely rounded, fawn colour: cilia fawn colour. Hindwings and cilia light ochreous-fuscous. Under surface of forewings to $\frac{4}{5}$, and costal half of hindwings to $\frac{3}{4}$ or nearly to notched apex smoky-black.

This is by far the darkest species of this genus yet described from Australia.

Brisbane; rare.

TIGRIODES SPLENDENS, n.sp.

40 mm. Head orange. Palpi and antennæ black. Thorax orange, patagia and dorsal tuft posteriorly blue-black. Abdomen ochreous-yellow. Legs yellow. Forewings elongate, costa slightly rounded, apex acute, hindmargin rounded, orange-yellow tinted with red; markings blue-black, costa for $\frac{4}{5}$ black;

in middle of costa a broad bar to half across wing, then expands toward base to $\frac{1}{3}$, forming a clavate figure towards inner margin; from $\frac{3}{4}$ costa to anal angle a line cuts off the triangle on apex of wing—which is blue-black, with an oblong ovate yellow spot at apex of wing: cilia black. Hindwings ochreous-yellow; cilia ochreous.

Mackay (Mr. Ronald Turner).

TIGRIODES TRANSCRIPTA, n.sp.

♂♀. 18-20 mm. Head, palpi, antennæ, thorax and abdomen light brown. Forewings narrow, elongate, costa gently arched, hindmargin rounded, light brown, with freely scattered fuscous scales; markings in many specimens indistinct, smoky-brown, 1st line from a dot in costa at $\frac{2}{5}$, angulated towards hindmargin and through two irregular dots to $\frac{2}{5}$ inner margin; 2nd line from dot in costa at $\frac{2}{3}$, irregularly and often denticulate, to $\frac{4}{5}$ of inner margin: cilia light brown. Hindwings and cilia light brown.

Brisbane; rare.

TIGRIODES NANA, Walk. Brisbane.

TIGRIODES SPILARCHA, Meyr. Brisbane; Melbourne.

TIGRIODES PULVERULENTA, n.sp.

♂♀. 24 mm. Head, palpi, antennæ, thorax and abdomen light grey fawn. Forewings narrow elongate, costa gently rounded, hindmargin oblique, slightly rounded, ochreous-brown with numerous fawn coloured scales aggregated on basal half of inner half, and apical half of costal half of wing: cilia ochreous-brown. Hindwings brownish-ochreous; cilia ochreous.

Allied to *T. spilarcha,* from which it differs in smaller size, uniformity of colour and absence of markings.

Brisbane; rare.

TEULISNA DASYPYGA, Feld. Daintree River.

BRUNIA HARPOPHORA, Meyr. Brisbane, Cooktown.

BRUNIA REPLETA, n.sp.

♂♀. 21-25 mm. Head, palpi, antennæ ochreous-fuscous. Thorax and abdomen greyish-ochreous. Forewings elongate, dilate, costa gently arched, hindmargin obliquely rounded, ochreous-brown, tinged with cinnamon-ochreous from near base, gradually getting lighter ochreous toward hind margin: cilia brown ochreous. Hindwings and cilia light brown ochreous.

Brisbane; rare.

BRUNIA FRAGILIS, n.sp.

♂♀. 14 mm. Head, palpi, antennæ, thorax and abdomen creamy-ochreous. Forewings elongate, somewhat dilated, costa gently arched, hindmargin obliquely rounded, pale straw or pale ochreous: cilia pale ochreous. Hindwings and cilia pale straw, lighter than forewings.

Brisbane; rare.

BRUNIA REPLANA, Lw. Brisbane.

BRUNIA INTERSECTA, n.sp.

♀. 32 mm. Head, palpi and thorax creamy-ochreous. Antennæ grey. Abdomen in specimen wanting. Forewings elongate, dilate, costa arched, hindmargin rounded, creamy-ochreous; a purplish dark grey band from costal half of base of wing, filling centre third of wing, upper border from costa at $\frac{1}{10}$ to near costa at $\frac{2}{5}$ where it forms a prominent angle, thence abruptly to near middle of wing at $\frac{7}{8}$, thence reflected forming an angle to costa just before apex; under border from base in centre of wing to near inner border at $\frac{3}{4}$, then reflected as an angle to inner border, veins on this band black, a sub-marginal line of black angular

dots, bounded by a light ochreous fine line and by a deep black hindmarginal fine line: cilia purple-grey. Hindwings yellow-ochreous, hindmargin near apex, black with short fine transverse black lines; cilia yellow-ochreous, near apex purple-grey.

Queensland. In Museum collection, Brisbane; believed to be from North Queensland.

Lithosia chionora, Meyr. Brisbane.

Lithosia unicolor, n.sp.

♂♀. 28 mm. Head, palpi ochreous-yellow. Antennæ light brown. Thorax ochreous-yellow. Abdomen ochreous-brown. Forewings elongate, moderately dilated, costa gently arched, hindmargin obliquely rounded, light ochreous-yellow: cilia ochreous-yellow. Hindwings and cilia as forewings, in some specimens a little lighter.

Brisbane.

Simmetrodes nitens, Walk.

♂. Described by Meyrick, P.L.S.N.S.W. He says he identified my three specimens from Walker's description only, and may be mistaken. Walker's descriptions are very meagre, and several species are superficially very similar in appearance. I obtained more specimens and I believe ♀ at Dunwich, Stradbrook Island. The ♀ is slightly larger, and is a light straw colour, some specimens shaded with brown.

Dunwich, near Brisbane.

Heterallactis euchrysa, Meyr. Brisbane.

Calligenia pyraula, Meyr. Port Douglas.

Calligenia cyclota, Meyr. Port Douglas, Cairns.

Calligenia melitaula, Meyr. N. Queensland.

Calligenia structa, Walk. Dunwich, Brisbane (Rev. — Ash); N. S. Wales.

HECTOBROCHA PENTACYMA, Meyr. N. Queensland.

HECTOBROCHA MULTILINEA, n.sp.

♂♀. 25-32 mm. Head and anntenæ ochreous. Thorax ochreous, collar and base of patagia black. Abdomen ochreous, terminal segment in ♀ black at base. Legs ochreous, femora and tibiæ barred with smoky-black. Forewings oblong, broadly dilate, costa rounded, apex obtuse, hindmargin rounded, inner margin gently sinuous, ochreous; costa for $\frac{2}{5}$ in ♂, $\frac{1}{5}$ in ♀ black, six sinuous freely dentate transverse black bars from costa to inner margin black; 1st near base of costa to base of inner margin, 2nd from $\frac{1}{5}$ costa to $\frac{1}{4}$ inner margin; 3rd in ♂ close beyond and parallel, in ♀ from $\frac{2}{5}$ costa to just before $\frac{1}{2}$ inner margin, 4th and 5th close and parallel from near $\frac{3}{4}$ costa to near $\frac{4}{5}$ inner margin, 6th sub-marginal; there are discal and discoidal spots, one between the 2nd and 3rd bars, and one sometimes divided transversely into two between 3rd and 4th bars: cilia ochreous. Hindwings ochreous with a broad smoky-black hind-marginal fascia, extending from just below apex to $\frac{2}{3}$ toward anal angle; discoidal spots faint or absent; cilia ochreous. Brown hairy larvæ on rocks; probably feed on lichens.

Brisbane.

HECTOBROCHA SUBNIGRA, n.sp.

♀. 32 mm. Head light fawn colour. Palpi black. Antennæ, thorax and abdomen, light smoky-fawn colour. Forewings elongate, dilate, costa arched, apex rounded, hindmargin rounded, smoky-fawn colour with markings of smoky-black; dot at base, one at inner margin close to base, a larger one in centre near base, and a narrow mark between this and costa black; fine line on costa to $\frac{1}{2}$ black; there are four rounded angular zig-zig lines, 1st from $\frac{1}{4}$ costa to $\frac{1}{4}$ inner margin; 2nd from just before $\frac{1}{2}$ costa to just before $\frac{1}{2}$ inner margin, these are united by four transverse lines, or touchings of their angles, and contain a black dot at $\frac{1}{3}$

from costa; at same distance from costa just before $\frac{2}{3}$ is a larger black dot; 3rd line from $\frac{2}{3}$ costa to $\frac{2}{3}$ inner margin; 4th line from $\frac{4}{5}$ costa to $\frac{4}{5}$ inner margin—these two lines with suffusion of smoky-black in the angles form a fascia, with the lighter ground-colour in middle and more towards inner margin; sub-marginal line very angulated or deeply toothed, lighter than other lines and forming dots round anal angle: cilia smoky-fawn colour. Hindwings and cilia same colour as forewings, with broad smoky suffused sub-marginal band, not touching margin, from costa to anal angle.

Brisbane; one specimen. November; dense scrub.

NEOBROCHA PHAEOCYRA, Meyr. N. Queensland.

TERMESSA GRATIOSA, Walk. Brisbane.

TERMESSA CONGRUA, Walk. Brisbane.

TERMESSA CONOGRAPHA, Meyr. Brisbane, Maryborough.

ZIA TACTALIS, Walk. Rockhampton.

THRYPTICODES XYLOGLYPTA [Meyr. MS.], n.sp.

♂♀. 24-26 mm. Head ochreous-grey. Palpi long, white-grey. Antennæ smoky-grey. Thorax and abdomen brownish-grey. Forewings elongate, triangular, costa rounded, apex obtuse, hind-margin rounded, brown or ashy-grey, irrorated with darker grey scales, and brown, chocolate and black often variable markings; a dark spot from costa near base nearly to inner margin, a brown rhomboid blotch from costa at $\frac{2}{3}$ for one third towards anal angle of hind margin, a thin sub-lunar line from costa immediately beyond, nearly along costa, minute brown spots along costa to near apex, a small suffused blotch of brown scarcely touching hind margin at $\frac{1}{4}$; a suffused brown border along whole inner margin; a black bar, more or less suffused, from hindmargin just before anal angle, one-third toward base and angle obliquely to inner

margin at $\frac{3}{5}$: cilia brown and grey. Hindwings whitish-grey, darker suffusion near hindmargin; a cluster of brown-grey hairs just before $\frac{1}{2}$ costa; cilia whitish-grey.

Brisbane.

Mr. Meyrick kindly named this species for me.

SAROTRICHA UNDULANA, Hb.

I have taken fourteen specimens of a *Sarotricha* at Brisbane, which Mr. Meyrick considers to be *S. undulana* This is a British species, and naturally led to the idea that it must be a mistake. But my specimens are certainly not English. They were taken at light. I hope to obtain more and better marked specimens next season, and so enable Meyrick to confirm his opinion or, what I believe will rather be, to find this to be a new allied species. Of course it may be an introduced species. I do not know its food plant. But an English moth is hardly likely to establish itself so near the tropics and not in Tasmania, N. Zealand, Melbourne or Sydney.

SAROTRICHA DEMIOTA, [Meyr. MS.] n.sp.

♂♀. 20-24 mm. I sent Meyrick what appeared to be two species of this genus. He has returned them both named as above. The one type is a blue-grey with black lines, the other is a brown-grey, with black lines and brown and black spots and blotches. Head grey. Palpi blackish-grey. Antennæ grey. Thorax grey, some specimens with darker collar, and bounding black line. Abdomen grey—easily greases. Forewings and costa slightly rounded, hindmargin rounded, grey or grey and brown interspersed. In some specimens basal fourth dark grey-black, with black lines and border, many short black dots on costa, several in basal half reaching to centre of wing; one irregular sinuous denticulate line from costa at $\frac{3}{4}$ to $\frac{3}{4}$ inner margin, in some specimens a deep black or brown spot on costa, a sub-marginal

line just beyond fainter, irregular and toothed; in some specimens a dark discal spot near centre of wing at $\frac{2}{3}$; in some suffusions of rust colour, brown near centre of wing and costa; in some only irregular pencillings at irregular distances, and for varied lengths transversely across wing: cilia grey. Hindwings white-grey or brown-grey, with smoky suffusion towards apical half of hindmargin; cilia grey.

Brisbane.

If Meyrick's determination be right, a most variable moth.

SAROTRICHA PUNCTATA, n.sp.

♂♀. 26 mm. Head, palpi creamy-grey. Antennæ grey. Thorax smoked-grey, two black dots in front, four immediately behind, and three posteriorly. Abdomen brownish-drab. Forewings with costa gently rounded, hindmargin rounded, creamy-grey suffused in patches with smoky-drab and brown, and covered with deep black dots; a dot at base in centre, one at $\frac{1}{5}$ costa and from this a series of spots more or less united to $\frac{1}{6}$ inner margin; a dot at $\frac{1}{3}$ inner margin; an angular spot at $\frac{2}{5}$ costa, further angled to a dot on middle of wing at $\frac{2}{5}$—thence interrupted to a dot at $\frac{1}{2}$ inner margin; a dot beyond $\frac{1}{2}$ costa, and in a line of interrupted dots to $\frac{3}{5}$ inner margin; a conspicuous spot at $\frac{3}{4}$ costa, thence an irregular zigzag grey line $\frac{2}{3}$ inner margin, a fine line at $\frac{5}{6}$ costa, and a line often divided into two dots at apex of costa, thence as a zigzag interrupted line of dots to just before anal angle of inner margin, a sub-marginal row of fine dots on veins: cilia grey. Hindwings grey becoming browner toward hindmargin and there forming a suffusion of brown; cilia grey.

Brisbane; 4 specimens.

SOROCOSTIA MESOZONA, [Meyr. MS.] n.sp.

♂♀. 15 mm. Head in some specimens snow white, in others grey. Palpi, antennæ grey. Thorax white. Abdomen grey.

Forewings elongate-triangular, costa gently arched, hindmargin rounded, white with scattered grey scales, and rich brown markings; a broad central fascia, not touching costa at middle, to middle of inner margin, with dots or short marks of black-brown, one or two or three brown dots, irregular, near base, a line of finely defined black dots just before central fascia, two or three faint dots near costa before apex, a sub-marginal line of dots: cilia grey. Hindwings white; cilia grey.

Brisbane; rare. Mr. Meyrick has kindly named this species for me.

SOROCOSTIA AULACOTA, Meyr. Brisbane.

SOROCOSTIA ARGENTEA, n.sp.

♂♀. 11-14 mm. Head, palpi, antennæ, and thorax silvery white, Thorax grey, covered more or less with silvery white. Forewings elongate-triangular, costa rounded, hindmargin obliquely rounded, grey-white with freely scattered silvery scales, costal edge finely grey, tufts at $\frac{2}{5}$ and $\frac{3}{5}$, sub-costal black with raised silvered scales—two small black dots, one between the 1st tuft and inner margin, the other at $\frac{1}{5}$ and a little distant from inner margin, surrounded by silvered scales; in some specimens the veins show grey, and there is a grey sinuous zigzag line from apex of costa to just before anal angle of inner margin, but in most specimens these are obscured by the silvery scales: cilia white. Hindwings and cilia greyish-white.

Brisbane; rare.

SOROCOSTIA CYCOTA, Meyr. Brisbane.

SOROCOSTIA LEUCOMA, Meyr. Brisbane.

SOROCOSTIA INTERSPERSA, n.sp.

♂♀. 13-18 mm. Head dark grey, face white, palpi and antennæ grey-white. Thorax grey, patagia darker grey. Abdomen grey,

base of segments smoky-grey. Forewings oblong, dilate, costa rounded, hindmargin oblique, scarcely rounded, white-grey, with markings of grey and lines of smoky-grey; 1st line from $\frac{1}{6}$ costa to $\frac{2}{3}$ toward inner margin, space within this line to the base more or less suffused with grey and bounded on inner margin with two smoky dots; 2nd line $\frac{1}{3}$ costa to $\frac{1}{2}$ inner margin, costal half dentate, inner half finer dotted; 3rd line from $\frac{2}{3}$ costa to $\frac{3}{4}$ inner margin, finely and frequently dentate, broader in centre, and containing with 2nd line a grey space and a smoky-grey angulated or lunar discal line; 4th line immediately beyond and parallel to 3rd line dentate, intervening space white-grey; beyond this line are three smoky-grey dots in costa, with an apical greyish suffusion; costa grey and smoky-grey. Hindwings white-grey with irregular suffusion of smoky-grey; cilia grey.

Brisbane.

NOLA LUGENS, Walk Brisbane, Cooktown; Melbourne.

NOLA METALLOPA, Meyr. Brisbane; Melbourne.

MOSODA JUCUNDA, Walk. Brisbane, Gayndah, Duaringa.

MOSODA BANCROFTI, n.sp.

♂♀. 18-21 mm. Head, palpi and antennæ black, collar reddish-brown. Thorax black. Abdomen orange-brown, terminal segment black above, orange-brown on under side. Legs black, middle tibiæ and posterior femora and tibiæ light orange-brown. Forewings elongate, costa arched, apex rounded, hindmargin obliquely rounded; purplish-black, with five rounded orange-brown spots; first on inner margin at $\frac{1}{4}$, 2nd on costa $\frac{2}{5}$, 3rd obliquely beyond this, on middle third of wing, touching 2nd and sometimes confluent, 4th touching anal angle of hindmargin, and 5th touching costa, just before apex: cilia black. Hindwings orange-brown with black border, deep at apical angle, but becoming attenuated to a mere line at anal angle of hindmargin; cilia black.

Brisbane; dense scrub; September, flying in sunshine. I have much pleasure in naming this species after Dr. T. L. Bancroft, who has given me much assistance in collecting.

MOSODA VENUSTA, n.sp.

♂♀. 18 mm. Head reddish-ochreous. Palpi dark smoky-grey. Antennæ smoky-grey, lighter towards extremity. Legs ochreous-brown. Thorax black, dotted anteriorly with reddish-ochreous. Abdomen black, anal tuft ochreous. Forewings elongate-triangular, costa moderately arched, hindmargin obliquely rounded, reddish-ochreous with black bands edged with deeper red; short bar on base of costa joins a spot in centre of base of wing, and joins a short bar at base of inner margin; a deep band from $\frac{1}{2}$ costa to $\frac{2}{3}$ inner margin, once denticulate in centre on both borders; a second band from $\frac{4}{5}$ costa to anal angle of hindmargin, sometimes diffused to apex and contracted opposite middle of hindmargin. Hindwings ochreous-red, darker than forewings, with a broad hindmarginal black band, broadest at apex.

Brisbane.

MOSODA SEJUNCTA, Feld. Brisbane; Melbourne.

MOSODA LINEATA, n.sp.

♂♀. 14 mm. Head grey. Palpi brown. Antennæ smoky-grey. Thorax white with a black V-shaped mark on dorsum. Abdomen greyish-white. Forewings triangular, costa gently rounded, hindmargin nearly straight, grey-white with black-brown markings; triangular dot on costa near base attenuated to base; a narrow bar angulated in middle from $\frac{1}{3}$ costa to just before $\frac{1}{2}$ inner margin; a bar at $\frac{2}{3}$ diffused to near apex of costa and narrowing to $\frac{3}{4}$ inner margin, sub-dentate; an interrupted band on hindmargin; costa black and grey. Hindwings and costa grey, darker grey toward margin, indistinct discal spot.

Brisbane; 5 specimens. Near to *Mosoda servilis*.

MOSODA SERVILIS, Meyr. Toowoomba; Melbourne.

SCAEODORA RAVA, n.sp.

♂♀ 12-15 mm. Head, palpi, antennæ, thorax, abdomen and legs fuscous-grey. Forewings elongate, dilate, costa rounded, apex and hindmargin rounded, brown-grey with a few scattered darker scales; costal line darker, with a dark triangular spot near apex; lines excepting sub-marginal faint smoky-grey; 1st from $\frac{1}{4}$ costa to $\frac{1}{4}$ inner margin; 2nd from $\frac{1}{3}$ costa to $\frac{1}{3}$ inner margin, in some specimens these two lines enclose a dark suffusion, a well defined discal spot at $\frac{2}{5}$, one-third from costa; 3rd line from $\frac{3}{5}$ costa, convex to hindmargin to $\frac{1}{2}$ inner margin; 4th line or sub-marginal line, a series of dark brown dots on the veins; marginal line fine: cilia light grey and brown. Hindwings light whitish-brown, marginal line darker brown.

Brisbane.

This is a larger species than *S. omophanes*, Meyr., which I discovered at Frankstone, Victoria. It may have to be made into a new genus, but provisionally I have retained it here.

CHIRIPHE MONOGRAMMARIA, Walk. Brisbane, Toowoomba.

CHIRIPHE DICHOTOMA, Meyr. Brisbane.

CHIRIPHE DICTYOTA Meyr. Brisbane, Toowoomba.

CHIRIPHE ANGULISCRIPTA, n.sp.

♂♀. 20 mm. Head white. Palpi and antennæ black. Thorax black in front, white behind, with white epaulettes, banded with black line at base. Abdomen smoky-grey, anal tuft creamy-ochreous. Forewings elongate, costa rounded, hind margin oblique, straight, white, markings black; costal spot near base, extended half way to inner margin; six irregular lines or

interrupted dots; an oblique spot on costa at $\frac{1}{5}$ from near which 1st line curves outward to $\frac{1}{4}$ inner margin; an irregular triangular spot on costa at $\frac{1}{2}$ from the centre of which 2nd line bends sharply toward base of wing and then abruptly turns to $\frac{1}{2}$ inner margin, where it is suffused into a large spot, and receives third line from a point short of costa at $\frac{3}{4}$; 3rd line waved; at $\frac{4}{5}$ costa is an oblong spot, from which proceeds 4th line to near anal angle of inner margin, and fifth line which joins 6th or hindmarginal line near anal angle: cilia white, with darker spots. Hindwings smoky-grey; cilia grey.

Brisbane; September, October; on fences. Allied to *C. dictyota.*

THALLARCHA PHALAROTA, Meyr. (T. PHAEDROPA, Meyr.).

The latter is but the ♀ of the former, consequently the name *phaedropa* must drop; several pairs taken *in cop.*

Brisbane; November: Myrtleford and Melbourne, Victoria.

THALLARCHA AURANTIACEA, n.sp.

♂. 16 mm. Head black, face orange. Palpi orange. Antennæ black. Thorax and abdomen black. Forelegs black; femora and tibiæ of middle legs ochreous-yellow; posterior legs ochreous-yellow. Forewings elongate, costa rounded, hindmargin obliquely rounded, black, iridescent with purple; second fourth of wing transversely orange: cilia black. Hindwings orange, with a rich black border round inner and hindmargin, and broadened at apex of costa; cilia black.

Brisbane; September; dense scrub.

COMARCHIS EQUIDISTANS, n.sp.

♂. 25 mm. Head ochreous. Palpi black. Antennæ grey. Thorax black, anterior edge finely ochreous and an oval oblong spot

posteriorly on dorsum ochreous, patagia entirely black. Abdomen ochreous, dorsum of middle segments and dorsum and sides of posterior segments black, anal segment ochreous. Forewings elongate, costa gently rounded, hindmargin obliquely rounded, ochreous with red toward inner margin: 5 black equidistant transverse bars, 1st near base and 5th just before hindmargin, 2nd, 3rd and 4th equidistant between: cilia ochreous. Hindwings ochreous-red, with broad marginal smoky-grey fascia, divided from before centre to apex of hindmargin; sub-marginal division lighter; cilia smoky-ochreous.

Toowoomba (Mr. Boyd).

COMARCHIS GRADATA, n.sp.

♂. 30 mm. Head and face ochreous, crown of head streaked with black. Palpi black. Antennæ grey. Thorax black, three ochreous dots anteriorly. Abdomen black, base of segments narrowly ochreous, anal tuft ochreous. Legs grey, under surface ochreous. Forewings elongate-triangular, costa nearly straight, apex acute, hindmargin rounded, ochreous, markings black; 1st narrow bar at base of wing; 2nd from $\frac{1}{4}$ costa to $\frac{1}{4}$ inner margin, narrowing on costa as costal line to basal bar; 3rd from $\frac{1}{2}$ costa to $\frac{3}{4}$ inner margin, bars 2 and 3 united by bar in middle, forming roughly the letter H; 4th bar $\frac{3}{4}$ costa to just before anal angle of inner margin, a short bar crosses this at $\frac{1}{3}$ from costal margin and projects half way to hindmargin, with short denticulation on opposite side, a 2nd cross-bar nearer inner margin reaches to hindmargin; hindmarginal line narrowly black: cilia black. Hindwings ochreous, with broad hindmarginal black fascia, narrowing toward anal angle; cilia black.

Toowoomba (Mr. Boyd).

COMARCHIS STAUROCOLA, Meyr. Brisbane.

COMARCHIS SPARSANA, Walk. Brisbane; Melbourne.

Comarchis irregularis, n.sp.

♂♀. 20 mm. Head, face, and antennæ white. Palpi very short, black. Collar black. Thorax black. Abdomen reddish-ochreous. Forelegs blackish-brown, underside reddish-ochreous; posterior legs reddish-ochreous. Forewings elongate-triangular, costa rounded, hindmargin obliquely rounded, creamy white, with fuscous-brown lines and fasciæ. Costal line fuscous-brown, broad at base and touching inner margin near base, and attenuated to ½ costal—a line from point of this costal line at ½ costa, irregularly dentate to ⅓ inner margin; a 2nd line from same point on costa, irregularly dentate, to ½ inner margin, enclosed space between these two lines reddish-ochreous and more or less suffused with rich fuscous-brown; a 3rd line from ¾ costa rounded to just before anal angle of inner margin, space between this and hindmargin fuscous-brown—except spot at ¾ hindmargin creamy white; the 2nd and 3rd lines are joined by a short line just below centre of wing; discal spot on first line near costa, or sometimes absorbed in 1st line: cilia brown and white. Hindwings reddish-ochreous, with diffusion of smoky-black at apex, narrowly attenuated to just before ½ hindmargin; cilia light ochreous.

Brisbane; rare. Allied to *aspectatella,* but is larger, and fasciæ lie obliquely inwards, and are differently arranged.

Comarchis obliquata, n.sp.

♂♀. 14 mm. Head, and dorsum of thorax ochreous; face, palpi, antennæ, sides of thorax, abdomen ochreous-fuscous. Legs brownish-ochreous. Forewings elongate, costa rounded, hindmargin obliquely rounded, inner margin sinuate, whitish-ochreous; markings fuscous, a narrow costal line from base to ⅔, extended at base interruptedly or continuously to inner margin; a line just below costa at ¼, enclosing a suffused grey to costa and obliquely to posterior end of costal line; 1st line from ⅔ costa obliquely to ⅓

inner margin irregular, sparsely denticulate; 2nd line from $\frac{4}{5}$ costa obliquely to $\frac{2}{3}$ inner margin, denticulate, enclosed space between 1st and 2nd lines suffused with fuscous-ochreous, and irrorations of black, and holding a small black discoidal spot almost touching 1st line; 3rd line from apex of costa to anal angle of inner margin, sinuous, suffused near apex and broadly so at anal angle; fuscous spot in middle of hindmargin encloses with 3rd line an ochreous space crossed by dark fuscous veins; cilia ochreous with spots of fuscous. Hindwings ochreous-grey, darker grey towards hindmargin; cilia ochreous with grey spots.

Melbourne; Brisbane. Near *C. staurocola.*

COMARCHIS ASPECTATELLA, Walk. Brisbane.

COMARCHIS LUNATA, n.sp.

16 mm. Head and face white, palpi black, antennæ grey. Thorax black, anteriorly and posteriorly white. Abdomen yellow-ochreous. Forewings elongate, dilate, costa gently rounded, hindmargin oblique, straight, covered with dark fuscous, excepting a white lunule from near base to near middle of inner margin, a white band from $\frac{3}{4}$ costa to $\frac{3}{4}$ inner margin divided obliquely near inner margin into two by bar, and 5 dentate white marks on hindmargin; small black discal spot edged with ochreous near centre of wing. Hindwings yellow, with smoky-grey fascia from apex attenuated towards hindmargin.

Brisbane.

ANESTIA INQUINATA, n.sp.

♂. 19-20 mm.—♀. probably apterous. Head ochreous-grey, line between antennæ grey. Palpi short, black. Antennæ ochreous, pectinations grey. Thorax ochreous-grey, lined anteriorly, laterally and posteriorly with black lines. Abdomen ochreous. Forewings elongate-triangular, costa slightly rounded, apex rounded, hindmargin obliquely rounded; light fuscous with lighter scattered

scales; semicircular spot in centre of inner margin creamy-ochreous, a second spot irregularly rhombic obliquely from 1st, and touching costa fuscous-grey, often indistinct; in some specimens two small creamy dots on inner margin at $\frac{1}{3}$ and just before anal angle: cilia fuscous. Hindwings orange, bordered with brown fascia, deep at apical angle but attenuated to a line to just before anal angle; cilia grey.

Brisbane.

ASURA LYDIA, Don. Brisbane; Melbourne.

ASURA CERVICALIS, Walk. Brisbane; and Victoria near the coast.

ASURA AURATA, var.

This appears to be a climatic variety of *A. cervicalis;* it is smaller, and while the southern type is intensely black this is intensely orange. In a large series the markings, though somewhat variable, are, relatively speaking, alike in the two types.

SPILOSOMA BRISBANENSIS, n.sp. (included with *S. fuscinula*, Walk.).

♂♀. 35-41 mm. Head reddish-fuscous. Palpi and antennæ black. Thorax fuscous with central and lateral black stripes from behind collar. Abdomen rose-red, with dorsal, lateral and ventral rows of black spots. Legs black, femora rosy, fuscous above. Forewings, costa slightly rounded, hindmargin rounded; in ♂ ochreous, in ♀ fuscous; markings black, a well defined bar on basal third, in some specimens filling basal half of costa; discal spot near costa at $\frac{1}{2}$, a black line on inner side of lower median vein occupying middle third very narrow in ♀, in some ♂ specimens duplicated, in a very few trebled; a narrow bar from near base close to and parallel to inner margin, interrupted in the third fourth, and often only a dot in ♀ in basal half; near $\frac{4}{5}$ costa are two small contiguous spots, and just below opposite to median line are two other smaller dots; from apex to near angle of hindmargin

a series of short longitudinal bar spots; in ♀ a second series runs diagonally from apex of hindmargin to $\frac{3}{4}$ of inner margin. In many specimens some or nearly all markings absent. Hindwings rosy, large discal spot, broad fascia close to and parallel with hindmargin, more or less interrupted in ♂, rarely interrupted in ♀.

This species is I am persuaded quite distinct from the following, *S. quinquefascia*. I have seen about 200 specimens from Brisbane neighbourhood and they are all constant as follows:—the markings of the inner $\frac{2}{3}$ of the forewings are sparse, being confined to the central *longitudinal* bars, the transverse fasciæ found in the next species are absent, the markings of the outer third hardly form into fasciæ, being short and more or less separated bars. The fascia of the hind wing is separated from the hindmargin by a well-defined border. The tendency is to sparsity of markings; the ♀ is *always* fuscous.

Spilosoma quinquefascia, n.sp. (included in *S. fuscinula*, Walk.).

The distinguishing feature in this species is the transverse fasciæ of the forewings, of which there are five; 1st is near the base, and consists of short bars or joined into a contiguous band; 2nd from $\frac{1}{3}$ costa to near $\frac{1}{4}$ and thence in a curve to $\frac{1}{3}$ inner margin, in some specimens narrowly interrupted; 3rd from $\frac{2}{3}$ costa twice waved outwards and from median obliquity to $\frac{1}{2}$ of inner margin, generally united to discal spot; 4th from $\frac{4}{5}$ costa to $\frac{4}{5}$ inner margin, in some specimens interrupted once or oftener in middle third; 5th on hindmargin, in some frequently interrupted, often covering hindmarginal line; in ♂ these fasciæ are often more or less confluent, in ♀ they are more deeply banded and give the insect a rich black appearance, often almost to leaving only lines of ground colour. The basal costal bar often curves into 2nd fascia. The thorax is often entirely black. The fascia of the hindwing is broader than in *S. Brisbanensis*, and leaves only a narrow hindmarginal line of ground colour.

Meyrick in his monograph description of *S. fuscinula* appears to have included both species. I have a long series of *S. quinquefascia* from Victoria, and they are quite distinct from the Brisbane species. It is difficult to say to which type the name of *S. fuscinula* was first given. Both have evidently been included. I would suggest the more descriptive name *S. quinquefascia* for those from the south with the transverse bars.

Areas marginata, Walk. Brisbane, Gippsland.

Deiopeia pulchella, L. Brisbane, Australia generally.

HYPSIDÆ.

Nyctemera amica, White. Brisbane to Melbourne.

Nyctemera tertiana, Meyr. Port Douglas to Brisbane.

Nyctemera crescens, Walk. Port Douglas to Mackay.

Nyctemera separata, Walk. Cape York to Mackay.

Nyctemera cribraria, Cl. Cape York to Brisbane.

Amerila astreas, Drury. Cape York.

Amerila brachyleuca, Meyr. Cooktown to Brisbane

Amerila serica, Meyr. Rockhampton and Gayndah.

Amerila rubripes, Walk. Cooktown to Brisbane.

Hypsa basilissa, Meyr. Cooktown and Cairns.

Hypsa dama, F. Cape York to Mackay.

Hypsa plagiata, Walk. Bowen to Brisbane.

Hypsa Caricæ, F. Cape York to Mackay.

Hypsa australis, Boisd. Mackay (Turner).

Hypsa nesophora, Meyr. Brisbane; N. S. Wales.

Hypsa chloropyga, Walk. Cape York to Mackay.

Digama marmorea, Butl. Duaringa to Brisbane.

SYNTOMIDIDÆ.

AGAPHTHORA MELANORA, Meyr. Cape York.

AGAPHTHORA SPHENODES, Meyr. Cairns.

HYDRUSA ECLIPTIS, Meyr. Cooktown and Port Douglas.

HYDRUSA STELOTIS, Meyr. Cooktown.

HYDRUSA PYRRHODERA, Meyr. Cape York to Port Douglas.

HYDRUSA ANGUSTIPENNA, n.sp.

♂♀. 19-25 mm. Head and palpi black. Antennæ black. Thorax black. Collar orange-red. Abdomen yellow or orange, base of segments black, anal segment entirely black. Forewings elongate-triangular. Costa straight, apex rounded, hindmargin very obliquely rounded, black, spots 4, small in ♂, moderate in ♀, yellow, translucent, dividing wing into fifths: 1st basal fifth ground colour; 2nd two spots, costal one triangular, inner one lunular, nearly extending to anal angle; 3rd fifth ground colour; 4th fifth two spots, inner one divided by sub-median vein, sub-costal one also divided and sometimes into three in ♀: cilia brown-red. Hindwings scant, less than half expansion of fore wings, black with one central orange-red spot; cilia brown-red.

Coast nr. Brisbane.

HYDRUSA HYALOTA, Meyr. Cape York.

HYDRUSA LEUCACMA, Meyr. Cooktown to Brisbane.

HYDRUSA CYANURA, Meyr. Brisbane.

HYDRUSA ANTITHETA, Meyr. Gayndah.

HYDRUSA PARAULA, Meyr. Cooktown to Brisbane.

HYDRUSA ANEPSIA, Meyr. Cooktown.

HYDRUSA PYROCOMA, Meyr. Rockhampton.

HYDRUSA SYNEDRA, Meyr. Rockhampton.

HYDRUSA HESPERITIS, Meyr. Cape York.

HYDRUSA MACROPLACA, Meyr. Brisbane; Sydney.

HYDRUSA NESOTHETIS, Meyr. Brisbane; Murray R.

HYDRUSA APERTA, Walk. Queensland; N.S. Wales.

HYDRUSA ANNULATA, F. Cooktown to Maryborough.

HYDRUSA INTENSA, Butler. Cooktown to Brisbane.

HYDRUSA PHEPSALOTIS, Meyr. Maryborough.

HYDRUSA ESCHATIAS, Meyr. ? Queensland.

HYDRUSA BICOLOR, Meyr. Cairns.

CHOROMELES GEOGRAPHICA, Meyr. Rockhampton to Brisbane.

CHOROMELES STREPSIMERIS, Meyr. Bowen.

EUCHROMIA POLYMENA, L. North Australia.

EUCHROMIA IRUS, Cr. Cape York and Cooktown.

ZYGÆNIDÆ.

HESTIOCHORA XANTHOCOMA, Meyr. Duaringa.

PROCRIS CORONIAS, Meyr. Maryborough.

PROCRIS SUBDOLOSA, Walk. Cape York to Brisbane; Melbourne.

PROCRIS VIRIDIPULVERULENTA, Guér. Duaringa; Melbourne.

BOMBYCES, Family LIPARIDÆ.

TEARA BARNARDI, n.sp.

♂♀. 38 mm. ♂. Head ferruginous-brown. Antennæ drab-brown, pectinations long. Thorax ferruginous-brown with tufts

of cream-coloured hairs, a small tuft enveloping root of each antenna. Abdomen black, terminal segment and anal tuft of hairs ferruginous-brown. Forewings triangular, dilate, costa rounded at base, thence obliquely straight, apex and hind margin rounded, grey-white, with fuscous markings; a narrow line extends along costa from base to $\frac{4}{5}$; from end of this obliquely to middle of inner margin is the 1st broad bar of fascia; from just before apex of costa a second rounded bar, symmetrical with hindmargin, spans the wing to $\frac{4}{5}$ inner margin, beyond this a sub-marginal line; this is united along veins with 2nd bar by short lines, and forms eight ground-coloured spots between the lines: cilia same colour as markings, fulvous. Hindwings grey-fuscous, with a darker shade bar just before middle of wing, and a 2nd at $\frac{3}{4}$, both symmetrical with hindmargin—the latter is edged by a darker line, shot with ferruginous, enclosing eight cream-coloured spots; cilia cream-colour.

♀. Head and thorax deep ferruginous-brown. Antennæ drab-brown, pectinations $\frac{1}{3}$ length of those in ♂. Forewings ochreous-yellow, dusted freely with chocolate-brown; markings deep chocolate-brown; the brown dustings become a line on costa from $\frac{1}{3}$ to apex, and they almost become a suffusion in middle of wing from base to first bar of fascia: 1st bar from $\frac{2}{3}$ costa to $\frac{1}{2}$ inner margin, 2nd bar from $\frac{5}{6}$ costa to $\frac{5}{6}$ inner margin, sub-marginal fine line—between line and 2nd bar are lines separating eight ochreous-yellow spots: cilia chocolate-brown with small ochreous-yellow points. Hindwings and cilia dark fulvous with light ochreous-yellow spots near hindmargin, and yellow points in cilia.

Duaringa, Queensland.

The sexes of this moth are widely different. They were bred from a batch of caterpillars by Mr. Barnard of Duaringa, after whom I am pleased to name the species.

TEARA ARGENTOSA, n.sp.

♂. 38, ♀. 46 mm. Head and thorax cream colour, long hairs on head and thorax creamy-white. Antennæ brown. Forewings

elongate, dilate, costa nearly stright, hindmargin obliquely rounded, cream colour, freely irrorated with silver and sparingly dusted with ochreous-brown; markings faint, light ochreous-brown; discal spot near apex of cell small and often indistinct; a bar or fascia from $\frac{1}{5}$ costa to $\frac{1}{4}$ inner margin, more distinct in ♂ than in ♀; a sub-marginal denticulate line, united by dentations (sometimes indistinctly marked) with a marginal line, and enclosing ground colour dots: cilia cream colour. Hindwings cream colour in ♂, light brown in ♀, a faint suffusion near base, a band from $\frac{3}{4}$ costa to $\frac{3}{4}$ inner margin, a sub-marginal and a marginal line on hindmargin light ochreous-brown; the sub-marginal and marginal lines are connected by short lines and enclose spots of ground colour; these marks are faint and more of a light brown in ♀; the long hairs on inner margin are light brown; cilia cream colour.

Duaringa, Queensland. (Mr. Barnard).

TEARA PROTRAHENS, n.sp.

♂♀. 27-30 mm. Head, palpi, antennæ ochreous-brown. Thorax ochreous-brown. Abdomen ochreous-brown, base of each segment black, terminal tuft ochreous-brown. Forewings elongate-triangular, with costa rounded, hindmargin very obliquely rounded, grey irrorated with brown and black scales; very large discal spot beyond $\frac{1}{2}$ and near costa, creamy colour with centre shade of brown; a sub-marginal row of eight cream colour spots and interrupted cream colour marginal line, in ♀ a line, in ♂ a broader band and ochreous: cilia ochreous and brown. Hindwings smoky-black: in ♂ cream colour row of hindmarginal spots, reduced in ♀ to three small ochreous dots next apical angle; cilia in ♂ ochreous, in ♀ smoky-brown and ochreous. The ♂ is in general appearance lighter than ♀.

Brisbane; rare.

PORTHESIA (EUPHROSTIS) COLLUCENS, n.sp.

♂♀. 26-34 mm. Head snow-white. Palpi ochreous. Antennæ mid rib white, pectinations ochreous-grey. Thorax snow-white.

Abdomen white, but hairs short, scattered, easily rubbed off, and showing ochreous-brown body colour. Forewings triangular, dilate, with costa rounded, hindmargin obliquely rounded, and inner margin rounded; snow-white; raised shining silvery lines give the appearance of corrugations, eight or nine of these stretch from near, but not touching inner border, rising at equal distances along the margin, the first four or five reach to cell, the others diagonally and irregularly reach to just before costa; the veins are more or less silvered white: cilia snow-white. Hindwings plain snow-white; cilia snow-white.

This beautiful species can best be described as imitative of water marked snow-white silk.

Brisbane, a pair in 1888.

BOMBYCES, Family SATURNIDÆ.

ANTHERÆA INTERMEDIA, n.sp.

♂. 125-160, ♀. 130-170mm. Head and palpi red-brown. Antennæ brown. Thorax red-brown, collar *conspicuously white.* Abdomen red-brown. Forewings broadly triangular, costa arched, apical half and apex rounded, hindmargin sinuous and obliquely rounded, *red-cinnamon-brown.* Costal band continuous with collar, attenuated to just before apex, slaty-purplish, freely dusted with grey and white on border, browner towards apex; large black blotch at termination of costal band; a short bar of chocolate-brown $\frac{1}{8}$ to $\frac{1}{4}$ inch long near $\frac{1}{3}$ costa, *not touching costal band, no white on inner side;* a larger bar of like colour from $\frac{1}{4}$ inner margin for two-thirds across wing to opposite $\frac{1}{6}$ costa; *a double bar* from $\frac{3}{5}$ inner margin to just before the black blotch near apex of costa, inner bar deep chocolate-brown, outer bar slaty or purplish-brown, bars wavy, and space between ochreous-brown; a circular discal ring occupying middle third between outer bar and costa deep chocolate, finely edged with white on inner margin nearest costa, translucent spot in middle a mere round dot; a broad hindmarginal ochreous-brown

band, apex suffused red centred with ochreous-white: cilia ochreous-brown. Hindwings coloured as forewings; a rich chocolate waved and curved bar from $\frac{1}{4}$ costa to $\frac{1}{3}$ inner margin, thence along inner margin to second bar which reaches from $\frac{3}{4}$ inner margin and in a curved line gradually nearing margin to $\frac{5}{6}$ costa; a marginal band bordering inner and hindmargins ochreous-brown, as in forewings; discal rings broadly black, with a blue and black line edging inner margin nearest base of wing, and occupying the middle third of space between the two chocolate bars—translucent spot a fine dot only; cilia as forewings. On the underside of wings fuscous and smoke-coloured scales are dusted thickly between discal ring, costa and outer bar, forming a suffusion over forewings and over all excepting middle third of hindwings. The double bar becomes a crimson-red band along inner half of forewings. The hind band alone is seen on hindwings, of which the inner third is crimson-red, whence it is gradually suffused with smoky-brown.

The species of *Antheræa* are in many cases very variable. *A. janetta* varies exceedingly. So does *A. eucalypti.* Other species are less variable. Many are closely allied in general appearance. It is only from a study of the creatures in nature, and from a long series of specimens, that we can hope to define the various species. *A. intermedia* comes very near to *A. eucalypti.* The caterpillar is much more gaudily coloured in the former. *A. eucalypti* is much more generally distributed. I have found it from Melbourne to Cooktown. *A. intermedia* is found in the Gippsland zone. I found it 800 to 1000 feet high in Gippsland. The Gippsland fauna comes down to sea-level at Brisbane. This evidently proves that the rainfall has more to do with the locale of many species than the differences of heat and cold. I have obtained scores of Lepidoptera in Gippsland at 800 to 1200 feet, and in Brisbane at sea-level only. The cocoon of *A. intermedia* is larger, more silky and shining than that of *A. eucalypti.* The relative size of the sexes is more nearly alike in *A. intermedia.* The colour is constant in *A. intermedia.* It varies from grey, brown, drab, cream, fulvous, &c., in *A. eucalypti* The triangular white blotch on the costa in *A. eucalypti* is absent in *A. intermedia.*

The collar is snowy-white, and not dirty grey-white as in *A. eucalypti.* The marginal lines on both wings and the double bar with the intermediate suffusion distinguish *A. intermedia.* But the most striking character is the distance of the discal rings from the bars. In *A. eucalypti* they touch, or nearly touch, the diagonal transverse bar in the forewings, and almost touch the single bar and suffusion in the hindwings. In *A. intermedia* they are conspicuously and constantly distant. *A. intermedia* appears to approach more nearly to a species which feeds on *Loranthus*, and which I have not yet been able to determine.

Gippsland and Brisbane.

GEOMETRINÆ, Family GEOMETRIDÆ.

PROBLEPSIS CLEMENS, n.sp.

♀. 40 mm. Head and collar blackish, lower half of face white. Palpi blackish-grey. Antennæ whitish-ochreous. Thorax and abdomen white. Legs ochreous above, white beneath. Forewings triangular, costa gently arched, hindmargin obliquely rounded; snow-white; lines or narrow bars across wing water-grey, 1st line $\frac{1}{4}$ costa to $\frac{1}{3}$ inner margin; 2nd line rounded near costa, but not touching costa, at $\frac{3}{5}$ to $\frac{2}{3}$ inner margin; 3rd line narrower, symmetrical with 2nd line from $\frac{3}{4}$ costa to $\frac{4}{5}$ inner margin; 4th line a row of small circular spots between veins, lighter on inner half, sub-marginal line just beyond this, fine and indistinct; marginal line very fine and distinct; a small discal spot just before 2nd line, subtended by a short indistinct line or suffusion and surrounded by a suffusion of silvery scales, a few sparsely scattered silvery scales toward apex, and others crowded along 2nd line toward inner margin, and just before inner margin as a broad suffusion to first ilne at $\frac{1}{4}$ from inner margin: cilia snow-white. Hindwings with hindmargin rounded, snow-white; a very narrow linear transverse discal spot margined on inner side with silvery scales, lines as in forewings, excepting that first line is wanting; suffusion of silvery scales in a space bounded by a line from $\frac{1}{3}$ inner margin through

discal spot to near apical angle of hindmargin, and by inner and hindmargins, suffusions very thick near inner border, more sparse and scattered toward hindmargin; cilia snow-white.

One specimen; Brisbane.

Appears to come nearest to *P. sancta* of the Australian species.

IODIS SPECIOSA, n.sp.

♀. 32 mm. Head green, fillet green. Palpi brown, terminal joint white. Antennæ light brown. Thorax bright pea-green, with a conspicuous dorsal white posterior spot. Abdomen green, with a white dot on dorsum of each segment; lower half of sides, undersurface and anal segment white. Forewings with costa arched, hindmargin rounded and crenulated, rich pea-green, thinly scaled; a white dot in costa near base, a second at $\frac{1}{6}$, a third at $\frac{1}{3}$, other minute white dots, indistinct, irregularly toward apex; a white dot at $\frac{1}{2}$ inner border; an indistinct row of white dots from $\frac{3}{5}$ costa to $\frac{3}{5}$ inner margin; a few minute white dots scattered irregularly on inner margin and on veins all over the wing, and more conspicuous white dots on apices of hindmarginal crenulations: cilia green and white. Hindwings with hindmargin rounded, bent at vein 4, and crenulate, rich pea-green, minute white dots with difficulty detected sparingly scattered over wing, apices of crenulations of hindmargin white; cilia green and white.

Taken by Mr. Turner near Mackay. Allied to *I. iosticta*, Meyr.

AGATHIA ASTERIAS, Meyr. Brisbane; one specimen.

AGATHIA LÆTATA, Fabr.

One specimen of this Indian species taken at Brisbane by Mr. Wild, in Museum collection, not previously recorded from Queensland.

HYPOCHROMA VIRIDICATA, n.sp.

♂. 45 mm. Head grey with dots of green, crown green. Palpi grey. Antennæ light brown, shortly pectinated. Collar reddish-

brown. Thorax grey-green, epaulettes blue-green. Thorax grey-green, sides and anal tuft reddish-ochreous. Forewings, costa slightly wavy, apex rounded, hindmargin rounded, rich green, freely interspersed with grass green, and dots of darker green; markings green-black and reddish-brown; a narrow line near base; a 2nd rounded line from a large spot at $\frac{1}{3}$ costa to $\frac{1}{4}$ inner margin; a large spot at $\frac{3}{5}$ costa and a line within this running to 2nd line at $\frac{1}{3}$ and ending in a blotch which covers discoidal spot; 3rd line from $\frac{3}{4}$ costa, dentate, curved outward and at $\frac{1}{3}$ inward to $\frac{1}{2}$ inner margin; 4th line from $\frac{4}{5}$ costa to $\frac{4}{5}$ inner margin, these two lines joined in the centre by a conspicuous black bar; 5th line irregular and interrupted, just beyond 4th; 6th line marginal: cilia grey-green. Hindwings as forewings; markings as forewings but 2nd and 3rd brown or black near centre of wing, veins brown and green, inner margin broadly reddish-ochreous; cilia brownish-green. Undersurface, forewings red-ochreous, discoidal spot black, bar from near $\frac{5}{6}$ costa to near anal angle narrowed in centre, deep red with spots of black near centre, a black comma mark in centre of wing at $\frac{1}{3}$. Hindwings as forewings, discoidal spot red; between this and outer broad band is a line from $\frac{3}{5}$ costa to centre of wing—all marks on hindwings cinereous-red.

Brisbane; in dense scrub; November; very rare. A very fine species. Allied to *H. hypochromaria.*

HYPOCHROMA MACULATA, n.sp.

♀. 44-46 mm. Head brown or grey. Palpi black. Antennæ brown. Thorax brown or grey, with 3 or 4 small black dots on either side of basal segments. Forewings triangular, dilate, costa straight, apex rounded, hindmargin rounded, light brown or light grey, with darker markings and spots; small dots along whole length of costa, with a large one at $\frac{1}{4}$, one at $\frac{1}{2}$, one at $\frac{3}{4}$ and one at $\frac{5}{6}$; a row of suffused dots near the base, a 2nd row of irregular suffused dots at $\frac{1}{8}$ costa in a circle to $\frac{1}{4}$ inner margin, a discal spot in centre of cell, more or less in a line of suffusion

with dot at $\frac{1}{2}$ costa to a dot at $\frac{1}{3}$ inner margin; a broad fascia of suffused darker ground colour from between dots at $\frac{3}{4}$ and $\frac{5}{6}$ costa to space between $\frac{1}{2}$ to $\frac{3}{4}$ inner margin, a darker blotch near hind-margin of this in centre, and another near inner margin; a sub-marginal interrupted crenulate line; a row of black hindmarginal dots between veins: cilia brown or grey. Hindwings marked as forewings, with small, faintly marked discal spot; under-surface light-ochreous with large black discal spot in forewings, small in hindwings; 1st line at $\frac{1}{5}$ costa or $\frac{1}{5}$ inner margin, faint; median line beyond discal spot at $\frac{1}{2}$ costa angled and thence to near $\frac{1}{2}$ inner margin, both lines wanting or faintly marked on hind wings. Very broad and smoky-brown hindmarginal fascia through both wings, touching hindmargin in forewings near the middle and in several points near anal angle, and in hindwings at apical and anal angles.

Mackay (Mr. Turner). Two specimens; one is grey, the other is fuscous-brown, but all the markings are alike.

Hypochroma Turneri, n.sp.

♀. 36 mm. Head and palpi greenish-ochreous. Antennæ greenish-grey. Thorax brown with tufts of green hairs. Thorax ochreous-drab. Forewings, costa nearly straight, hindmargin crenulate, rounded, ochreous-green shaded with purplish-grey suffusions and markings; a dark chocolate or blackish denticulate median line at $\frac{2}{3}$ costa, angularly toward hindmargin, thence straight for $\frac{1}{4}$, and thence obliquely to $\frac{1}{2}$ inner margin; another line less distinct at $\frac{1}{3}$ costa, denticulate and rounded to $\frac{1}{5}$ inner margin; a broad purple-grey suffusion at base, narrowly separated into two blotches in centre, a second suffusion of same colour between chocolate lines along costa bordering either line, and filling space on inner $\frac{2}{3}$ of wing, this contains indistinctly marked discal spot; a narrow suffusion and a darker colour line diagonal to costa at $\frac{4}{5}$ costa, a green-purple bar from $\frac{3}{4}$ inner margin to middle of wing, thence diagonally to near hindmargin at $\frac{1}{4}$ from

apical angle, here it turns on itself and extends near hindmargin to anal angle; space included purple-grey, marginal line chocolate-grey: cilia brown, grey, and green. Hindwings as forewings, with a patch of reddish-ochreous on middle third of inner margin, and very indistinct discal spot or suffusion. *Undersurface* of wings ochreous shaded with purple-grey, from base to median line, discal spot on forewings conspicuous black with white suffusion toward median line and costa, discal spot on hindwings pale, indistinct; median line $\frac{2}{3}$ costa to $\frac{2}{3}$ inner margin on forewings, and in a line from beyond $\frac{1}{2}$ costa to $\frac{1}{2}$ inner margin hindwings. A broad grey-black fascia from costa just beyond median line, touching hindmargin near anal angle in forewings, and at apex and anal angle in hindwings.

Mackay; one specimen sent by Mr. Turner; after whom I have great pleasure in naming the specimen. This species is allied to *H. acanthina*, Meyr.

NOCTUÆ, Family ORTHOSIDÆ.

LEUCANIA AUREOLA, n.sp.

♂. 38 mm. Head, palpi, thorax and abdomen ochreous-brown. Antennæ ochreous above, smoky-brown beneath. Legs ochreous-brown. Bunch of long hairs on undersurface and centre of abdomen black. Forewings, costa rounded before apex, hindmargin rounded, ochreous-brown, with veins and finely lined subvenations reddish-brown; a strongly marked brown line midway through wing to $\frac{2}{3}$, parallel with inner margin; a small black discal spot almost touching this line just beyond $\frac{1}{2}$, another small spot just outside first, an oblique brown line from just before apex of costa becoming a suffusion to discal spot, an oblique brown line, suffused at apex, but narrowing into a series of dots to $\frac{3}{4}$ inner margin, a few other irregular indistinct suffused brown spots and dots, and grey-black marginal dots on veins: cilia ochreous-brown. Hindwings ochreous-brown, freely covered with smoky-brown scattered scales, which become a dark suffusion on hind half of wing; cilia

as forewings. Undersurface of all wings creamy-ochreous and covered with shining gold scales. Marginal dots on veins black.

Brisbane; rare; dense scrub; November.

Leucania fumata, n.sp.

♂♀. 31-35 mm. Head smoky-grey. Palpi grey. Antennæ brownish-grey. Thorax white, smoky-grey anteriorly. Thorax ochreous-white. Forewings elongate, gradually dilate, with costa gently rounded, hindmargin rather obliquely rounded, milk white, shining, shaded irregularly with smoky-grey; small brown discal spot near centre of cell, often indistinct; veins bounding cell, and veins nearing hindmargin smoky-grey: cilia greyish-white. Hindwings grey-white, with broad band of suffused smoke colour on hindmargin, lighter toward anal angle; cilia as forewings.

Brisbane; rare.

I sent a specimen of this rare moth to Mr. Meyrick, who returned a note, *unidentifiable.* I presume it became greased in transit, to which it is very liable, and in which condition it would look worn and rubbed. In the fresh series, the shining wings, milky-white forewings shaded with smoke stains as it were, readily distinguish it from any other species with which I am acquainted.

PYRALIDINA, Family PYRALIDIDÆ.

Balanotis arctandalis, n.sp.

♂♀. 25-35 mm. Head orange. Palpi black, grey laterally. Antennæ ochreous-grey. Thorax green-grey, with two black dots in front, and two diamond-shaped black spots in centre and posteriorly across dorsum. Abdomen ochreous-orange laterally, green-grey on back, with a centre row of diamond spots and a row diagonally with these on either side, black, terminal tuft black with a shade of orange in centre. Legs green-grey and black, posterior pair on upper side orange on coxæ and femora,

and alternately orange and black on tibiæ. Forewings elongate-triangular, gently dilate, costa nearly straight, hindmargin rounded, green-grey, with marks and shadings of grey and black in various shades; spot in centre near base, a larger one at $\frac{1}{8}$ costa, a broader and diffused one immediately beyond on costa, a smaller just beyond in middle and one nearer base on inner margin—a broad fascia from $\frac{1}{3}$ costa deeply dentate to $\frac{1}{3}$ inner margin, widened at inner margin, a discal spot at $\frac{1}{2}$ near costa, a 2nd fascia at $\frac{2}{3}$ costa sinuous and dentate to $\frac{4}{5}$ inner margin, a broad suffusion from just beyond to apex, on inner half of wing narrowed to interrupted horseshoe dots, to anal angle of hindmargin; a sub-marginal line of deep black dots, a marginal black-grey line: cilia black-grey. Hindwings with hindmargin rounded, costa for $\frac{3}{5}$ and whole inner margin rich orange colour, rest of wings coloured as forewings but with more white: spot near base of costa orange, large spot in middle of wing at $\frac{1}{3}$, and a band from near costa just before sub-marginal spots on middle $\frac{2}{4}$ of wing, blue-white: a suffused line near base in centre and between costal orange and white, centre spot green-grey; a fascia at $\frac{1}{2}$ between orange bands and bounded faintly on either side with orange-black: a broad suffusion from apex of costa, breaks at $\frac{1}{4}$ into horseshoe spots on inner side of white band and expands in suffusion near anal angle, black: sub-marginal spots deep black; cilia as forewings.

Brisbane; rare; dense scrub.

This handsome species comes near *B. carinentalis*.

Postscript.—Since this paper left my hands I have come to the conclusion that it might perhaps be better to consider the foregoing species (*B. arctandalis*) as a well-marked variety of *B. didymalis*, Walk. It does not entirely agree with Walker's description in which the markings on the under side are said to be obsolete, whereas in my species (or variety) the under surface is rich orange, and the markings deep black.

NOTES AND EXHIBITS.

Mr. Skuse exhibited specimens of Diptera as follows:—(1) Cecidomyidæ bred from small brown scale-like discolorations occurring very numerously on the leaves of *Eucalyptus corymbosa* common about Sydney; (2) another species bred from globular, valvate, galls found on the hill-pine (*Frenela Endlicheri*) near Wagga Wagga, N.S.W.; (3) specimens of a species of *Phora* bred from the larvæ of *Oiketicus elongatus*, Saund.

Mr. Froggatt showed the following exhibits:—(1) a specimen of a case-moth *Oiketicus elongatus*, Saund., together with a number of specimens of parasitic Hymenoptera (*Hockeria* sp., Fam. *Chalcididæ*) bred from a batch of dipterous larvæ (*Tachina* sp.), similar to those exhibited by Mr. Skuse at the September Meeting, parasitic upon the case-moth; (2) specimens of parasitic Hymenoptera (Fam. *Braconidæ*) which destroy the caterpillars of *Teara tristis*; (3) a family of the young caterpillars of a case-moth (*Oiketicus Hübneri*, Saund.), which when hatched a fortnight ago were little active black caterpillars, and immediately commenced to make their cases out of any suitable material that came to hand.

Mr. Fletcher exhibited a collection of about 110 species of plants from the neighbourhood of Wagga Wagga, which Dr. Woolls, with his customary kindness and enthusiasm, had been good enough to determine. Among the more interesting species represented perhaps the most noteworthy are *Bedfordia salicina*, DC., *Stuartina Muelleri*, Sond., *Vittadinia australis*, A. Rich., (two vars.), among the Compositæ; and *Caladenia clavigera*, A. Cunn., (Orchideæ). A few common Port Jackson plants were met with, and introduced plants were found to be very numerously represented.

The President exhibited a number of parasitic Nematode worms (*Ascaris* sp.), from the alimentary canal of the brown snake (*Diemenia superciliosa*), obtained and forwarded by Mr. McCooey.

MONDAY, 30TH DECEMBER, 1889.

The President, Professor Stephens, M.A., F.G.S., in the Chair.

Dr. W. Lloyd Mathias was present as a visitor.

Dr. N. A. Cobb was elected a member of the Society.

The President announced that the Annual Meeting would be held on Wednesday evening, January 29th, 1890, to take precedence of the Ordinary Monthly Meeting on the same date.

DONATIONS.

A Pamphlet entitled "Root Matters in Social and Economic Problems." By R. M. Johnston, F.L.S. *From the Royal Society of Tasmania.*

"Zoologischer Anzeiger." XII. Jahrg., Nos. 319, 320 and 321 (1889). *From the Editor.*

"Journal of Morphology." Vol. III., No. 1 (June, 1889). *From Dr. W. A. Haswell, M.A.*

"Report of the First Meeting of the Australasian Association for the Advancement of Science, held at Sydney, N.S.W., in August and September, 1888." *From the Association.*

"Feuille des Jeunes Naturalistes." No. 229 (November, 1889). *From the Editor.*

"Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou." Tome XV., Liv. 6 (1889). *From the Society.*

"Journal and Proceedings of the Royal Society of New South Wales." Vol. XXIII., Part I. (1889); "Catalogue of the Scientific Books in the Library," &c. Part I.—General Catalogue. *From the Society.*

"Archiv für Naturgeschichte." 53rd Jahrg., Band II., Heft 1 (1887); 55th Jahrg., Band I., Heft 2 (1889). *From the Editor.*

"Comptes Rendus des Séances de l'Académie des Sciences, Paris." Tome CIX., Nos. 12 and 13 (1889). *From the Academy.*

"The Victorian Naturalist." Vol. VI., No. 8 (December, 1889). *From the Field Naturalists' Club of Victoria.*

"Geological and Natural History Survey of Canada.—Contributions to Canadian Palæontology." Vol. I., Part 2. By J. F. Whiteaves, F.G.S., F.R.S.C., &c. *From the Director.*

"The Journal of Comparative Medicine and Surgery." Vol. X., No. 4 (1889). *From the Editor.*

"Bulletin of the American Museum of Natural History." Vol. II., No. 3 (three sheets). *From the Museum.*

A Pamphlet entitled "Notes on Certain 'Pores' on the Veins of some Diptera." By Frazer S. Crawford. *From the Author.*

"The Transactions of the Entomological Society of London for the year 1889." Part 3. *From the Society.*

"Department of Agriculture, Queensland.—Report on Insect and Fungus Pests." No. I. By Henry Tryon. *From the Under-Secretary for Agriculture, Brisbane.*

"Archives Néerlandaises des Sciences Exactes et Naturelles." Tome XXIII., Liv. 5 (1889). *De la part de la Société Hollandaise des Sciences à Harlem.*

"Berliner Entomologische Zeitschrift." Band XXXIII., Heft 1 (1889); "Stettiner Entomologische Zeitung." 50 Jahrg., Nos. 4-6 (1889). *From Sir William Macleay, F.L.S.*

Two Pamphlets entitled "Gums, and a Resin, produced by Australian Proteaceæ;" "Botany Bay or Eucalyptus Kino." By J. H. Maiden, F.L.S., F.C.S., &c. *From the Author.*

"Proceedings and Transactions of the Queensland Branch of the Royal Geographical Society of Australasia." 5th Session (1889-90). Vol. V., Part I., with a Map. *From the Society.*

"Proceedings of the Cambridge Philosophical Society." Vol. VI., Part 6 (1889). *From the Society.*

"Transactions and Proceedings and Report of the Royal Society of South Australia." Vol. XII. (1888-89). *From the Society.*

"The Australasian Journal of Pharmacy." Vol. IV., No. 48 (Dec., 1889). *From the Editor.*

"Abstract of Proceedings of the Zoological Society of London, 5th November, 1889." *From the Society.*

"The Quarterly Journal of the Geological Society of London." Vol. XLV., Part 4 (No. 180), 1889; "List of Members, &c., 1889." *From the Society.*

"The Asiatic Society of Bengal.—Proceedings, 1889." Nos. i.-vi. (Jan.-June); "Journal." n.s. Vol. LVIII., Part i., No. 1; Part ii., Nos. 1 and 2 (1889); "The Modern Vernacular Literature of Hindustan." By G. A. Grierson, B.A., B.C.S. ("Journal," Special Number, Part i., 1888). *From the Society.*

"Proceedings and Transactions of the Royal Society of Canada for the year 1888." (Vol. VI.) *From the Society.*

A Pamphlet entitled "Notes and Critical Remarks on a Donation of Shells sent to the Museum of the Conchological Society of Great Britain and Ireland." By John Brazier, F.L.S., &c. *From the Author.*

"Journal of the Royal Microscopical Society of London, 1889." Part V. *From the Society.*

DESCRIPTIONS OF ADDITIONAL AUSTRALIAN PYRALIDINA.

By E. Meyrick, B.A., F.E.S.

The following species, mostly new, are additions to the list of Australian *Pyralidina*, and include several forms of considerable interest. They are mostly received from my esteemed and energetic Queensland correspondents, Mr. G. Barnard of Coomooboolaroo, and Dr. T. P. Lucas of Brisbane.

PYRALIDIDAE.

Centropseustis, n.g.

Forehead with projecting tuft of scales; ocelli present; tongue well-developed. Antennæ $\frac{3}{4}$, in ♂ stout, dentate, moderately ciliated, with a fine obliquely projecting spine from near base of stalk above, basal joint moderately large. Labial palpi long, porrected, clothed with dense loose scales, in ♂ bent, in ♀ nearly straight, in ♂ with terminal joint enlarged and excavated internally and clothed with very dense expansible scales above and beneath. Maxillary palpi obsolete. Posterior tibiæ with outer spurs about $\frac{1}{3}$ of inner. Forewings with vein 1a simple, connected by a bar before middle with 1b, 6 approximated or from a point with 9, 7 and 8 out of 9, 10 connected with 9 at a point above 7. Hindwings over 1; veins 4 and 5 closely approximated at base, 7 out of 6, anastomosing with 8 at a point before middle.

A curious and distinct genus, allied to *Hypotia*.

Centr. astrapora, n.sp.

♂♀. 21-25 mm. Head and thorax whitish-ochreous, more or less mixed with brownish. Palpi whitish, externally fuscous. Antennæ whitish-fuscous. Abdomen whitish-ochreous, segments brownish-tinged except on margins. Legs fuscous, posterior tibiæ whitish. Forewings elongate-triangular, costa gently arched posteriorly, apex obtuse, hindmargin bowed, rather oblique; light brownish-ochreous, costa more brownish anteriorly; a cloudy white longitudinal spot in disc near base, sometimes extended to base, margined beneath by a short blackish dash; a nearly straight silvery-white streak from beneath costa at $\frac{2}{5}$ to $\frac{2}{5}$ of inner margin, posteriorly finely black-margined; a silvery-white streak from beneath costa at $\frac{3}{4}$ to inner margin at $\frac{2}{3}$, rectangularly angulated inwards below middle, anteriorly finely black-margined; space between these streaks ochreous-brown except on costa, with some blackish scales above middle; a closely and acutely dentate cloudy black line from apex to inner margin at $\frac{3}{4}$, nearly obsolete at lower extremity, indented inwards to touch second transverse streak above middle and again in its angulation; space between this line and second streak ochreous-brown; space beyond it more or less clouded with fuscous; a whitish hindmarginal line: cilia ochreous-brownish, with a row of blackish spots before middle. Hindwings deep yellow; a moderate dark fuscous hindmarginal band, suffusedly dilated at apex and anal angle; cilia yellowish, on upper half with an interrupted dark fuscous line before middle.

Sydney, New South Wales, in November and December; not often seen at large in the perfect state, but bred in plenty from the larva by Mr. G. H. Raynor and myself. Larva 16-legged, elongate, slender, cylindrical, very active; body transversely wrinkled, with a few long scattered pale hairs; reddish-ochreous on back, ochreous-whitish on sides; dorsal line narrow, ochreous-whitish, irregularly margined and lined with blackish; a broad double blackish lateral line, partially obscured with transverse black wrinkles; a dull ochreous reddish cloudy spot behind each

spiracle; an obscure interrupted blackish subspiracular line; head dull brownish-ochreous, reticulated with whitish, with two broader lines on crown: feeds gregariously in large nests of dense web, a foot in diameter, amongst branches of *Melaleuca genistifolia*; January to March.

SYNTONARCHA, n.g.

Forehead oblique; ocelli present; tongue well-developed. Antennæ $\frac{2}{3}$, in ♂ filiform, simple. Labial palpi long, straight, porrected, second joint clothed with rough projecting scales, terminal joint moderate, with loosely appressed scales. Maxillary palpi moderate, triangularly dilated with scales. Posterior tibiæ with outer spurs half inner. Forewings with vein 1 simple, cell in ♂ abruptly contracted anteriorly so that upper and lower margins are appressed together in disc from base to near middle of wing, 2 from $\frac{2}{3}$ of cell, 3 from much before angle, 4 and 5 approximated at base, 6 from a point with 9, 7 and 8 out of 9, 11 from $\frac{2}{3}$ of cell, bent upwards towards 12. Hindwings $1\frac{1}{4}$; veins 4 and 5 closely approximated towards base, 7 out of 6 near origin, anastomosing with 8 to middle.

This is a very singular form, superficially perhaps more like some of the *Galleriadae* than anything else, but quite peculiar; structurally it is undoubtedly to be referred to the *Pyralididae*, in the neighbourhood of *Cledeobia* and *Diplopseustis*.

Synt. iriastis, n.sp.

♂. 25 mm. Head, palpi, antennæ, and thorax light brownish-ochreous. Abdomen fuscous-whitish, basal segment deep yellow-ochreous. Legs fuscous-whitish, anterior pair fuscous. Forewings elongate, posteriorly considerably dilated, costa strongly arched, apex rounded, hindmargin obliquely rounded; light brownish-ochreous, with strong prismatic reflections: cilia fuscous-whitish. Hindwings whitish, semitransparent, with strong purplish and brassy reflections; cilia whitish.

Brisbane, Queensland; one specimen received from Dr. T. P. Lucas.

BOTYDIDAE.

GLYPHODES, Gn.

Glyph. luciferalis, Walk.

Brisbane, Queensland; one specimen received from Dr. T. P. Lucas. Occurs also in New Guinea, Java, and India.

Glyph. microta, n.sp.

♀. 15 mm. Head and thorax ochreous-brown, with a white line above eyes. Palpi dark fuscous, beneath white towards base. Antennæ fuscous-whitish. Abdomen light fuscous. Legs whitish. Forewings elongate-triangular, costa posteriorly moderately arched, apex obtuse, hindmargin bowed, oblique; fuscous, base ochreous-tinged; costa suffused with light greyish-ochreous; markings iridescent white, semitransparent, surrounded by a darker suffusion; a dot on inner margin at $\frac{2}{5}$; a small irregular spot in disc at $\frac{1}{3}$; a transverse suboblong spot in disc before middle, reaching from near costa to below middle; a pentagonal blotch in disc at $\frac{2}{3}$, not approaching either margin; a narrow transverse spot from costa at $\frac{4}{5}$, whence proceeds a slender line close round two lower sides of discal blotch to middle of disc, almost reaching preceding spot, thence very abruptly bent back and running in a sinuate course to inner margin at $\frac{3}{4}$; a blackish hindmarginal line: cilia light fuscous, with a darker line. Hindwings iridescent white, semitransparent; a small dark fuscous spot in disc before middle; a broad fuscous hindmarginal band, nearly of equal width throughout, anteriorly suffused with dark fuscous; cilia whitish, with a fuscous line.

Brisbane, Queenland; one specimen received from Dr. T. P. Lucas. Allied to *G. bicolor*; it is the smallest known species of the genus.

HYDROCAMPIDAE.

Tetrernia, n.g.

Forehead vertical; ocelli present; tongue well-developed. Antennæ $\frac{3}{4}$, in ♂ filiform, moderately ciliated (1). Labial palpi moderate, curved, ascending, slender, with appressed scales, second joint slightly roughened in front, terminal joint moderate, tolerably pointed. Maxillary palpi rudimentary. Posterior tibiæ with middle-spurs nearly equal, (terminal spurs absent, possibly broken, only one posterior leg being present), all tarsi very long. Forewings in ♂ with a small glandular swelling near base, a small costal projecting tuft of hairs at $\frac{1}{4}$, and small basal tuft on inner margin; vein 1 simple, 3, 4, 5 closely approximated at base, 6 and 7 approximated at base, 9, 10, and 11 rising out of 8. Hindwings 1; veins 4 and 5 stalked from near 3, 7 out of 6 near origin, anastomosing with 8 to middle.

The neuration is to be regarded as the distinguishing characteristic of this genus.

Tetr. teminitis, n.sp.

♂. 13 mm. Head, palpi, antennæ, and thorax pale whitish-yellowish. (Abdomen absent.) Legs whitish, anterior pair with apex of joints black. Forewings elongate-triangular, narrow at base, costa posteriorly gently arched, apex obtuse, hindmargin obliquely rounded; ochreous-yellow; a suffused dark fuscous streak along costa from base to beyond middle; an obscure white posteriorly dilated suffusion in disc above middle, extending from near base to $\frac{3}{4}$, posterior edge parallel to hindmargin; a quadrate yellowish spot in middle of disc, interrupting this suffusion, margined on both sides and above with dark fuscous; an evenly broad curved white black-margined fascia at $\frac{5}{6}$, parallel to hindmargin, not quite reaching costa or inner margin; an interrupted black hindmarginal line: cilia whitish, with a grey line. Hindwings ochreous-yellow; basal half white, bounded by a nearly straight

dark fuscous streak from beneath middle of costa to above middle of inner margin; an oblique white spot before apex; a moderate straight white blackish-margined fascia at $\frac{4}{5}$ parallel to hindmargin from above middle to near inner margin; five small subquadrate black spots on central third of hindmargin; cilia whitish, with a grey line, becoming dark grey opposite hindmarginal spots.

Cairns, Queensland, in September; one specimen received from Mr. G. Barnard.

Hydreuretis, Meyr.

Hydr. sacadalis, Walk.

(*Hydrocampa sacadalis*, [*sacadusalis*], Walk. 963.)

♀. 20 mm. Head and antennæ white. Palpi white, second joint dark fuscous, terminal joint pointed. Thorax white, with two transverse ochreous-yellowish bars. Abdomen white, with two bars and apex pale yellowish. Legs white, anterior tibiæ dark fuscous. Forewings very elongate-triangular, costa posteriorly slightly arched, apex obtuse, hindmargin rather obliquely rounded; white; a subcostal streak of pale fuscous irroration from base to middle; a small fuscous spot in disc beyond middle; a moderate ochreous-yellow fuscous-margined fascia from $\frac{2}{3}$ of costa towards anal angle, below middle acutely angulated and continued through disc to inner margin near base, rather sinuate upwards beneath discal spot; a straight ochreous-yellow fascia, narrowed downwards posteriorly and above margined with dark fuscous, from $\frac{5}{6}$ of costa to near inner margin before anal angle; a moderate ochreous-yellow hindmarginal fascia, margined on both sides with dark fuscous, touching preceding fascia on costa and anal angle, continued along inner margin to middle but gradually suffused and disappearing: cilia grey, with a darker line. Hindwings white; a straight fuscous line from $\frac{3}{5}$ of costa to middle of inner margin; a nearly straight ochreous-yellow fuscous-margined fascia from costa before apex to $\frac{3}{4}$ of inner margin; an ochreous-yellow blackish-margined hindmarginal fascia, confluent with preceding on costa, marked

with cloudy-grey apical and subapical spots; cilia whitish, with a grey line marked with blackish, with a black subbasal dot below apex, and two small black spots separated by a white dot above middle.

Sydney, New South Wales, in March; one specimen received from Mr. G. H. Raynor.

SCOPARIADAE.

ECLIPSIODES, Meyr.

Eclips. marmaropa, n.sp.

♀. 18 mm. Head and thorax black, with a few yellow-whitish scales. Palpi black, mixed with yellowish-white. Antennæ black. Abdomen dark fuscous, irrorated with yellowish, apex yellow. Legs blackish, sprinkled with yellowish. Forewings elongate-triangular, costa nearly straight, apex obtuse, hindmargin rather obliquely rounded; dark fuscous, irrorated with black, and irregularly sprinkled with whitish-yellowish; a cloudy white subbasal dot in middle, another on base of inner margin, an elongate mark beyond first, and three dots in a transverse series before middle, upper in disc above middle, all ill-defined and obscure; a subcrescentic yellowish-white spot in disc beyond middle, and a smaller spot on submedian fold beneath this; a suffused spot beyond discal crescentic spot; a hindmarginal series of cloudy roundish almost confluent yellow-whitish spots: cilia fuscous, with a darker line, and some terminal scattered yellowish-white scales. Hindwings with veins 4 and 5 stalked, 6 and 7 rising separate; light orange, with a few scattered dark fuscous scales; base and inner margin irregularly suffused with rather dark fuscous; a moderate irregular dark fuscous hindmarginal band, dilated at apex, almost interrupted at anal angle, marked with some yellowish scales indicating a series of obscure hindmarginal spots; cilia fuscous, mixed with yellowish, with a darker fuscous subbasal line.

Mount Kosciusko (5000 feet), New South Wales; one specimen in January. The neuration of the hindwings varies somewhat from previously described forms of the genus, but its peculiarities are apparently only exaggerations of the type; in the absence of the ♂, its position is sufficiently assured.

ALUCITIDAE.

Alucita, Z.

Aluc. xanthodes, n.sp.

♂. 15 mm. Head white, crown light ochreous-yellow. Palpi white. Antennæ ochreous-whitish. Thorax yellow-ochreous, spotted with white. Legs white, anterior pair banded with dark fuscous. Forewings and hindwings bright yellow-ochreous, crossed by six irregular white lines; fifth and part of third lines finely margined anteriorly with black, fourth and sixth (subterminal) finely margined posteriorly with black: cilia alternately ochreous and white.

Duaringa, Queensland, in February; one specimen received from Mr. G. Barnard. A very pretty and distinct species.

Aluc. pygmaea, n.sp.

♂♀. 8-9 mm. Head and thorax white, speckled with dark fuscous. Palpi white. Antennæ whitish. Abdomen ochreous-white, sides speckled or suffused with dark fuscous, second segment white with a dark fuscous blotch on each side. Legs white, anterior tibiæ dark fuscous. Forewings and hindwings white, clearly and finely striated transversely throughout with ochreous-brown; six irregular clear snow-white transverse bars, finely margined on both sides with black: cilia wholly whitish.

Duaringa and Brisbane, Queensland, in February; five specimens received from Mr. G. Barnard and Dr. T. P. Lucas. Mr.

Barnard states that they sometimes swarm by thousands in the scrubs. It is a curious and interesting little insect, much the smallest species of the genus.

PTEROPHORIDAE.

TRICHOPTILUS, Wlsm.

Trich. pyrrhodes, n.sp.

♂. 12-13 mm. Head and thorax ferruginous, apex of patagia pale yellowish. Palpi white, upper and lower edge black, confluent towards apex. Antennæ black, dotted with white. Abdomen ferruginous, apex with single obliquely ascending hair-pencil. Legs white, longitudinally striped with black, posterior tibiæ and tarsi banded with blackish. Forewings cleft from middle, segments linear; ferruginous, with a few scattered purplish-silvery scales; a short black longitudinal dash above inner margin at $\frac{1}{5}$, and a second in disc at $\frac{1}{3}$; a black transverse dot on base of cleft, and a more or less marked dark fuscous suffused spot below it; first segment with an obscurely indicated light yellowish bar before middle: costal cilia pale yellowish, with a black spot at $\frac{1}{4}$ of first segment, a broader one in middle, and a third at apex; rest of cilia brown with a strong reddish-purple gloss, on upper margin of second segment with some black scales before apex, on lower margin of second segment with a pale yellowish bar at $\frac{1}{3}$, preceded and followed by black scales, a narrower bar at $\frac{2}{3}$ and another at apex, both preceded by black scales. Hindwings cleft firstly from $\frac{1}{3}$, secondly from near base, segments linear; deep coppery-red, becoming ferruginous at base; cilia brown with a strong purple-reddish gloss, third segment with a large tooth of black scales on inner margin at $\frac{2}{3}$, and one or two black scales at apex.

Duaringa, Queensland, in February and April; three specimens received from Mr. G. Barnard. It is very distinct by the intense reddish colouring, large black scale-tooth of hindwings, and other characters.

OXYCHIROTIDAE.

Cenoloba, Wlsm.

Forehead rounded; ocelli very small; tongue developed. Antennæ $\frac{3}{4}$, in ♂ serrate, moderately ciliated (1). Labial palpi long, straight, porrected, second joint with dense roughly projecting scales, terminal joint moderate, slender, cylindrical. Maxillary palpi rather long, porrected, triangularly dilated with loose rough scales. Abdomen in ♂ with moderate anal tuft, uncus not developed. Posterior tibiæ with outer spurs $\frac{3}{4}$ of inner. Forewings narrow, gradually dilated, hindmargin deeply cleft to $\frac{1}{2}$, segments elongate-lanceolate; 1 simple, 2 out of 3, 4 from point with 3, 5 and 6 obsolete, 7 from near 9, 8 out of 9, 10 out of 9 below 8, 11 out of 9 near origin. Hindwings narrow, gradually dilated, hindmargin deeply cleft to $\frac{2}{5}$, segments elongate-lanceolate; lower median not pectinated; 2 from before angle, 3 and 4 stalked, 5 short, to base of cleft, 6 from angle of cell, 7 out of 6 near origin, anastomosing with 8 to middle.

This singular genus has been erroneously referred to the *Pterophoridae*. I have elsewhere (Ent. Mo. Mag. Sept. 1889) discussed its affinities, and shown that it is truly referable here, and that its nearest ally is *Epharpastis*.

Cen. obliteralis, Walk.

(*Pterophorus obliteralis*, Walk. 945; *Cenoloba obliteralis*, Wlsm., Ent. Mo. Mag. XXI. 175, fig. 2.)

♂♀. 10-14 mm. Head whitish. Palpi and thorax whitish irrorated with ochreous. Antennæ whitish ringed with fuscous. Abdomen whitish. Legs white, narrowly banded with dark fuscous. Forewings white, irrorated with ochreous; markings

ochreous sprinkled with dark fuscous; a moderate transverse spot at base of cleft; three small spots on costa between $\frac{2}{5}$ and $\frac{3}{4}$, second almost confluent with spot at base of cleft; a moderate bar crossing middle of each segment, a narrower one between this and apex, and a dot at apex of each segment: cilia white barred with pale ochreous opposite segmental markings. Hindwings with colour and markings as in forewings, but without costal spots; spot at base of cleft extended to reach inner margin.

Brisbane, Queensland; several specimens received from Dr T. P. Lucas.

PHYCITIDAE.

Heosphora, Meyr.

Under my original description of *H. virginella*, Meyr., I unfortunately confused two species, which I have since been enabled to separate by the acquisition of additional material. As the description is no longer strictly determinable, I here describe both species afresh, retaining the name *virginella* for that which I originally regarded as the typical form.

Heosph. virginella, Meyr.

♂♀. 22-27 mm. Head, palpi, and thorax pale carmine-pink; palpi 4. Antennæ ochreous-whitish. Abdomen ochreous-whitish, basal third golden-ochreous. Legs whitish-pink. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, hindmargin very obliquely rounded; clear carmine-pink, sometimes ochreous-tinged towards costa; a slender white median longitudinal streak from base, becoming indistinct towards hindmargin; inner margin broadly suffused with ochreous-whitish from base to $\frac{2}{3}$: cilia light carmine-pink. Hindwings and cilia ochreous-whitish.

Duaringa, Queensland; four specimens received from Mr. G. Barnard.

Heosph. chlorogramma, n.sp.

♂♀. 14-17 mm. Head and thorax dull carmine-pink mixed with ochreous-whitish. Palpi 4, light dull pink, above and beneath whitish. Antennæ ochreous-whitish. Abdomen grey-whitish, basal third golden-ochreous. Legs white. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, hindmargin obliquely rounded; dull carmine-pink; costa and all veins clearly marked by ochreous-white lines; a slender ochreous-white streak along anterior half of inner margin: cilia light carmine-pink, costal cilia ochreous-white. Hindwings ochreous-whitish; cilia whitish, sometimes rosy-tinged.

Duaringa, Rosewood, and Brisbane, Queensland, in December and March; five specimens.

REVISION OF AUSTRALIAN LEPIDOPTERA.

By E. Meyrick, B.A., F.E.S.

III.

The families which form the subject of the present instalment are the *Hepialidae*, which must be regarded as the ancestral family of the *Bombycina*, and the *Monocteniadae*, the most characteristically Australian family of the *Geometrina*.

HEPIALIDAE.

Ocelli absent. Tongue generally obsolete. No maxillary palpi. Antennæ not more than half forewings. Tibiæ without spurs. Forewings with all main veins and costa connected by cross bars near base, 1 furcate towards base (furcation appearing as a parallel vein connected by terminal bar), 9 and 10 stalked, 11 from near base, forked parting-vein well-defined. Hindwings without frenulum; 1c present; neuration essentially identical with forewings.

This curious family is sharply defined and easily recognised by the peculiar type of neuration, which is practically identical in the forewings and hindwings. I regard it as clearly established that this character, now exceptional in the *Lepidoptera*, is ancestral. In the development of the order a tendency to reduction in size of the hindwings, and simplification of their neuration, was very early manifested; with the result that in almost all other families the normal number of veins in the hindwings is less by four than in the forewings. The basal cross bars are also an original character, very early lost. I have explained elsewhere (Trans. N.Z. Inst. 1885, 180) that these characters indicate the origin of

the *Lepidoptera* from the *Trichoptera*, and in the case of *Tineina* the transitional steps are all preserved. It seems to me an inevitable conclusion that the *Bombycina* originate by a parallel line of development through the *Hepialidae* from the same source; but at present, so far as my material enables me to judge, the transitional forms on both sides of the *Hepialidae* are missing, so that the family stands isolated. In this respect the Australian forms, though interesting, add nothing to our knowledge, and do not help to diminish the gaps.

The species are often extremely variable, and the descriptions are therefore necessarily made loose. The larvæ feed either in the stems of trees and shrubs, or beneath the ground on roots. The family is of universal distribution, but nowhere represented by any large number of species; probably the Australian species are more numerous than those of any similar region. In New Zealand there are nine species, all endemic, but belonging entirely to two Australian genera, *Porina* and *Hepialus*. The following is a tabulation of the eight Australian genera.

1.	Forewings with vein 8 out of 10..................	2.
	Forewings with vein 8 not out of 10......... ...	3.
2.	Forewings with vein 11 out of 10................	1. *Perissectis.*
	Forewings with vein 11 separate..................	2. *Porina.*
3.	Forewings with veins 7 and 8 stalked...........	4. *Hectomanes.*
	Forewings with veins 7 and 8 not stalked......	4.
4.	Antennæ subclavate.................................	3. *Oncoptera.*
	Antennæ not subclavate......................... ..	5.
5.	Antennæ in ♂ tripectinated.......................	8. *Trictena.*
	Antennæ in ♂ not tripectinated	6.
6.	Antennæ in ♂ unipectinated......................	7. *Pielus.*
	Antennæ in ♂ not unipectinated	7.
7.	Hindwings in ♂ partially tufted with long rough hairs..	6. *Leto.*
	Hindwings in ♂ not partially tufted with long rough hairs	5. *Hepialus.*

1. Perissectis, n.g.

Antennæ $\frac{1}{5}$-$\frac{1}{6}$, in ♂ stout, joints incised, simple. Palpi moderate, straight, porrected, basal and second joints clothed with dense rough projecting scales, terminal joint moderate, smooth, cylindrical. Posterior tibiæ densely rough-haired. Forewings with vein 7 from angle, 8 and 9 out of 10, 11 out of 10 above 8. Hindwings as in forewings.

Endemic; a special development of *Porina.*

1. *Per. australasiae*, Don.

(*Hepialus australasiae*, Don. Ins. New Holl., Walk. Bomb. 1558; *Elhamma inconclusa*, Walk. Bomb. 1562; *Pielus invarius*, Walk. Suppl. 599.)

♂. 37-42 mm., ♀. 52-85 mm. Head and thorax ochreous or brownish, often reddish-tinged. Antennæ light ferruginous. Abdomen light ochreous, reddish-tinged. Forewings elongate, subtriangular, costa slightly arched, apex rectangular, hindmargin obliquely rounded continuously with inner margin, in ♀ wing much more elongate and hindmargin more oblique; ochreous, more or less rosy-tinged, especially in ♀, thinly sprinkled with dark fuscous, and generally suffusedly spotted and marbled throughout with cloudy fuscous, more distinctly in ♂; usually more or less distinct darker fuscous irregular band from $\frac{1}{3}$ of inner margin to apex, sometimes quite obsolete: cilia whitish-ochreous, base fuscous, barred with dark fuscous. Hindwings in ♂ yellow-ochreous, slightly rosy-tinged, sometimes more or less infuscated except towards base; in ♀ pale ochreous-rosy, apex more ochreous.

Sydney and Blackheath (3500 feet), New South Wales; Melbourne, Victoria; from February to April, common.

2. Porina, Walk.

Antennæ $\frac{1}{4}$-$\frac{2}{5}$, in ♂ bipectinated or more or less shortly bidentate. Palpi moderate, porrected, basal joint rough-haired, second joint rough-haired or almost smooth, terminal joint smooth, sometimes

subclavate. Posterior tibiæ densely rough-haired. Forewings with vein 7 from angle, 8 and 9 out of 10, rising much before angle. Hindwings as in forewings.

Easily known by the neuration; the antennal characters vary specifically in the ♂, and all gradations can be found from strong pectinations to extremely short hardly noticeable dentations; they are very serviceable for specific distinction, but afford no practible basis for generic separation. The genus is characteristic of Australia and New Zealand, but I have also seen a species from South Africa.

1.	Forewings with conspicuous blackish spot above inner margin	9. *sphragidias.*
	Forewings without conspicuous blackish spot above inner margin	2.
2.	Hindwings red towards base	6. *rufescens.*
	Hindwings not red towards base..............	3.
3.	Antennal pectinations of ♂ 5..................	2. *fuscomaculata.*
	Antennal pectinations of ♂ not over 3......	4.
4.	Antennal pectinations of ♂ 3	5.
	Antennal pectinations of ♂ 1-1½.............	7.
5.	Forewings with numerous white spots	6.
	Forewings with discal white mark only......	5. *determinata.*
6.	Forewings with two posterior series of white spots	7. *niphadias.*
	Forewings with more than two posterior series of white spots	3. *australis.*
7.	Forewings with silvery-white discal spots...	4. *dirempta.*
	Forewings without silvery-white discal spots	8. *subvaria.*

2. *Por. fuscomaculata*, Walk.

(*Oxycanus fuscomaculatus*, Walk. Bomb. 1574; *O. pardalinus*, Walk. Suppl. 598.)

♂♀. 65-73 mm. Head and thorax dark fuscous or ochreous-brown. Antennæ yellowish-ochreous, pectinations 5. Abdomen

yellowish-ochreous, more or less suffused with fuscous. Forewings rather elongate-triangular, costa posteriorly gently arched, apex obtuse, hindmargin oblique, gently rounded continuously with inner margin; ochreous-brown or dark brown, sometimes lighter in disc, often irrorated with ochreous-whitish; five or six tolerably parallel curved transverse series of small triangular or trapezoidal dark fuscous spots, sometimes centred with ochreous; rarely a cloudy suffused white longitudinal streak in disc; a hindmarginal series of small dark fuscous spots: cilia fuscous or ochreous. Hindwings yellow-ochreous, more or less suffused with fuscous posteriorly; sometimes a faint posterior series of small fuscous spots; cilia brownish-ochreous.

Melbourne, Victoria; Launceston, Tasmania; Adelaide, South Australia; twelve specimens. The longer antennal pectinations (5) will distinguish this at once from all others.

3. *Por. australis*, Walk.

(*Oxycanus australis*, Walk. Bomb. 1574; *Pielus maculosus*, Feld. pl. LXXXI. 1.)

♂. 68-84 mm. Head and thorax fuscous. Antennal pectinations 3. Forewings ochreous-fuscous; numerous irregular small silvery-white dark-margined spots, larger and more irregular anteriorly, posteriorly arranged in three transverse series: cilia fuscous. Hindwings ochreous, fuscous-tinged.

Tasmania; five specimens.

4. *Por. dirempta*, Walk.

(*Porina dirempta*, Walk. Suppl. 597.)

♂. 68 mm. Head and thorax rather dark fuscous. Antennal pectinations $1\frac{1}{2}$, terminating in tufts of cilia. Abdomen yellow-ochreous. Forewings fuscous, becoming ochreous in disc anteriorly; anterior half of costa suffused with dark fuscous; a whitish longitudinal streak in disc from base, suffused on posterior half into a broad fuscous-whitish cloud extending to anal angle;

two small triangular silvery-whitish dark-margined spots on upper margin of this before middle; two or three partial series of small white dark-margined spots towards costa posteriorly. Hindwings yellow-ochreous.

South Australia; one specimen (Brit. Mus. Coll.). Probably this species may vary much in markings, and the form described has hardly the appearance of being typical, but the antennal characters are sufficient to distinguish it.

5. *Por. determinata*, Walk.

(*Elhamma determinata*, Walk. Bomb. 1563.)

♂. 58 mm. Head and thorax rather dark ochreous-fuscous. Antennal pectinations 3 (obscured through mould). Forewings ochreous-fuscous, with several obscure transverse series of subconfluent darker spots; an oblique transverse silvery-white mark, appearing to be composed of three small confluent spots, in middle of disc, preceded and followed by a darker fuscous suffusion. Hindwings ochreous-fuscous.

West Australia (?); one specimen (Brit. Mus. Coll.).

6. *Por. rufescens*, Walk.

(*Oxycanus rufescens*, Walk. Bomb. 1575.)

♂. 60 mm. Head and thorax rather dark fuscous. Antennal pectinations 2½. Abdomen suffused with red towards base. Forewings fuscous; two or three anterior dark fuscous dots in disc, and two posterior series of fuscous dots, all surrounded by ochreous rings; two silvery-white dark-margined adjacent dots in centre of disc. Hindwings dull fuscous-ochreous, towards base suffused with red.

Tasmania; one specimen (Brit. Mus. Coll.).

7. *Por. niphadias*, n.sp.

♂. 47 mm. Head dark fuscous. Antennæ yellow-ochreous, pectinations 3. Thorax ochreous-fuscous, anteriorly darker. Abdomen light brownish-ochreous. Forewings elongate, sub-

triangular, costa sinuate, posteriorly moderately arched, apex rounded, hindmargin obliquely rounded continuously with inner margin; fuscous, darker towards base of costa; two cloudy whitish spots obliquely placed in disc at $\frac{1}{3}$, and an irregular short longitudinal whitish mark in middle of disc; two nearly straight transverse series of subtriangular subconfluent whitish spots, not reaching either margin, first at $\frac{2}{3}$, second at $\frac{5}{6}$: cilia rather dark fuscous. Hindwings pale ochreous-fuscous, becoming more yellowish-ochreous towards base; cilia rather dark fuscous.

Mount Lofty, South Australia; one specimen received from Mr. E. Guest.

8. *Por. subvaria*, Walk.

(*Elhamma subvaria*, Walk. Bomb. 1562; *Oxycanus subvarius*, ib. 1575.)

♂. 41-55 mm. Head and thorax dark ochreous-fuscous. Antennal pectinations 1. Forewings ochreous-fuscous; two or three small scattered fuscous sometimes pale-centred spots in disc, and two posterior series of similar spots; a hindmarginal series of small fuscous spots: cilia ochreous or fuscous. Hindwings light ochreous-fuscous, sometimes with two posterior series of small fuscous spots.

Tasmania; three specimens (Brit. Mus. Coll.). The species has shorter antennal pectinations than in any other Australian form, excepting the following. There can be no doubt that Walker's two descriptions quoted above are actually drawn from the same specimens, though he appears in his catalogue to place them as a distinct species.

9. *Por. sphragidias*, n.sp.

♂. 56 mm. Head and thorax ochreous-brown. Antennæ light ferruginous, shortly dentate. Abdomen fuscous, apex deep ochreous. Forewings elongate-oblong, posteriorly hardly dilated, costa gently arched, apex obtuse, hindmargin obliquely rounded continuously with inner margin; deep yellow-ochreous, irregularly irrorated with ochreous-brown and dark fuscous; the absence of irroration

forms three series of moderate irregular subconfluent spots, first about $\frac{1}{4}$, strongly curved, second about middle, nearly obsolete on lower half, third about $\frac{3}{4}$, slightly curved; an ill-defined dark fuscous irregular cloudy longitudinal streak in disc from base to near hindmargin; a conspicuous subtriangular blackish-fuscous spot above inner margin at $\frac{1}{3}$; a smaller transverse-oval ochreous-white spot near beyond this: cilia yellow-ochreous, tips paler, sharply barred with dark fuscous. Hindwings rather dark fuscous; costa, a hindmarginal line, and veins posteriorly suffused with bright deep yellow-ochreous; cilia as in forewings.

Tasmania (?); two specimens received from Mr. A. Simson.

3. Oncoptera, Walk.

Antennæ $\frac{1}{6}$, gradually swollen towards apex so as to appear subclavate, simple, basal joint with a tuft of hairs projecting over eye. Palpi moderate, straight, porrected, slender, wholly clothed with long rough projecting hairs. All tibiæ densely rough-scaled; posterior tibiæ in ♂ with a very large broad curved tuft of very long hairs rising from above near base, and lying along abdomen. Forewings with vein 7 from angle, 8 from near before angle, 9 and 10 stalked. Hindwings as in forewings.

A curious form, differing from all others in the antennæ. Walker writes the generic name *Oncopera*, quoting it as a MS. name of Stephens, who evidently intended the orthographically correct name which I have restored above.

10. *Onc. intricata*, Walk.

(*Oncopera intricata*, Walk. Bomb. 1559.)

♂. 31-41 mm., ♀. 48 mm. Head, antennæ, thorax, and abdomen fuscous or ochreous-fuscous. Forewings suboblong, posteriorly somewhat dilated, costa slightly arched, apex rounded, hindmargin obliquely rounded continuously with inner margin; ochreous, ochreous-brown, or dark fuscous; generally more or less distinctly marbled with irregular paler or whitish markings, including rounded darker spots sometimes marked with blackish, but these

markings are sometimes wholly confused or obsolete; a pale oblique mark from inner margin near base, margined on each side with blackish, is generally conspicuous but sometimes obsolete: cilia with basal half ochreous-brown, terminal half white, sharply barred with dark fuscous. Hindwings rather dark fuscous; costa in ♂ suffused with whitish-ochreous or yellow-ochreous; cilia as in forewings.

Melbourne and Warragul, Victoria; Deloraine and Hobart, Tasmania; from October to December, common. A very variable species.

4. Hectomanes, n.g.

Antennæ $\frac{1}{5}$-$\frac{1}{2}$, in ♂ shortly bipectinated throughout. Tongue present, short. Palpi very short, clothed with long rough projecting hairs. All tibiæ and anterior tarsi clothed with dense rough hairs. Forewings with veins 7 and 8 stalked from angle, 9 and 10 stalked from near before angle, 11 from before middle. Hindwings as in forewings, but veins 7 and 8 sometimes from a point.

Differs from all in the structure of veins 7 and 8. Walker has applied the generic name *Fraus* to a species of this genus, but upon investigation it appears (1) that he adopted it as a MS. name of Stephens, (2) that he misread it, Stephens having apparently intended to write *Praus*, and (3) that this name (Gk. πραύς) ought to be written *Prays*, and it is therefore already preoccupied by Curtis for a genus of *Lepidoptera*; I have accordingly rejected Walker's name.

1.	Forewings reddish-ochreous........................	12. *simulans* ♂.
	Forewings fuscous..................................	2.
2.	Forewings with strong white streak from base to apex...	12. *simulans* ♀.
	Forewings with streak incomplete or absent...	3.
3.	Cilia fuscous......	11. *noserodes.*
	Cilia whitish-ochreous, barred with fuscous...	13. *polyspila.*

11. *Hect. noserodes*, n.sp.

♂. 30-35 mm. Head and thorax fuscous or dark fuscous. Antennæ and abdomen fuscous. Forewings elongate-oblong, posteriorly somewhat dilated, costa gently arched, apex rounded, hindmargin very obliquely rounded continuously with inner margin; fuscous or whitish-fuscous; numerous darker fuscous dots, tending to be arranged in longitudinal and transverse series, sometimes surrounded with fuscous-whitish rings; sometimes a straight very slender fuscous-whitish longitudinal streak from base to $\frac{2}{3}$, suffusedly margined above with dark fuscous, sometimes obsolete: cilia fuscous. Hindwings fuscous or whitish-fuscous.

Sydney, New South Wales; three specimens, in May.

12. *Hect. simulans*, Walk.

(*Fraus simulans*, Walk. Bomb. 1564; *F. bilineata*, ib. Suppl. 595).

♂. 22-25 mm. Head, antennæ, thorax and abdomen deep reddish-ochreous. Forewings suboblong, posteriorly somewhat dilated, costa faintly sinuate, apex rounded, hindmargin obliquely rounded continuously with inner margin; deep reddish-ochreous or ferruginous; a slender somewhat irregular straight white longitudinal streak in disc from $\frac{1}{5}$ to about $\frac{4}{5}$, sometimes wholly absent; traces of fuscous dots posteriorly: cilia reddish-ochreous. Hindwings rather dark fuscous; cilia reddish-ochreous; more or less mixed with dark fuscous.

♀. 32-36 mm. Head, antennæ, thorax, and abdomen fuscous. Forewings much more elongate and hindmargin more oblique than in ♂; fuscous, veins indistinctly streaked with reddish-ochreous; costal edge whitish-ochreous from near base to near apex; a moderate straight silvery-white longitudinal streak in disc from base, near hindmargin bent upwards to terminate in apex, on posterior half margined beneath with light ochreous-reddish; beneath this a series of obscure silvery-whitish short longitudinal streaks between veins before hindmargin, becoming larger down-

wards, terminating in a slender silvery-whitish streak along hindmargin : cilia whitish-fuscous, with a basal reddish-ochreous line. Hindwings fuscous-grey.

Sydney and Blackheath (3500 feet), New South Wales; Warragul, Victoria ; Tasmania ; March to May, common.

13. *Hect. polyspila*, n.sp.

♂. 31 mm. Head, antennæ, and thorax ochreous-fuscous. Abdomen light brownish-ochreous. Forewings elongate-triangular, costa sinuate, apex rounded, hindmargin obliquely rounded continuously with inner margin; fuscous; veins and a broad costal streak pale ochreous ; costal edge dark fuscous on basal $\frac{2}{3}$; fuscous portion strewn with numerous irregular suboval moderate whitish spots: cilia whitish-ochreous, slenderly barred with fuscous. Hindwings pale fuscous; costa and veins towards costa posteriorly ochreous; cilia as in forewings.

Wimmera, Victoria ; one specimen.

5. Hepialus, F.

Antennæ $\frac{1}{4}$-$\frac{1}{8}$, in ♂ simple. Palpi short or moderate, porrected, with rough projecting hairs, terminal joint naked, subclavate. Posterior tibiæ densely rough-haired, sometimes with long projecting tuft above in ♂. Forewings with vein 7 from angle, 8 from much before angle, 9 and 10 stalked from near 8. Hindwings as in forewings.

The Australian species of this genus, which are all more or less green, have generally been regarded as a distinct genus, under the name of *Charagia*, but I am unable to discover any structural difference from ordinary forms of the northern hemisphere, where the genus is mainly resident. I cannot therefore separate them generically, but they form an interesting subgroup. The larvæ of the Australian species feed in tunnels in the stems of trees or shrubs, eating by preference the bark round the mouth of the tunnel, and concealing themselves meanwhile under a broad

shelter of silk and refuse. The perfect insects are very retired in habit, and are rarely obtained except by breeding the larvæ. The notes on larvæ following are taken from Scott.

If the name *Hepialus* is derived from the Greek ἠπιαλος, it should of course be written without the aspirate; but it appears to me that this derivation is very doubtful, and that without more certainty it is undesirable to vary the usually adopted form.

1.	Forewings purple or fuscous-reddish, with green markings	2.
	Forewings green, with white or brown markings	4.
2.	Forewings anteriorly with a triangular green blotch.............	3.
	Forewings anteriorly with a sinuate green longitudinal band......	14. *Lewinii* ♀.
3.	Forewings with subapical blotch connected with anterior blotch.........	15. *lignivorus* ♀.
	Forewings with subapical blotch separate	16. *splendens* ♀.
4.	Hindwings yellow or red.................	5.
	Hindwings white or green	8.
5.	Forewings with markings brown........	17. *Scotti* ♀.
	Forewings with markings silvery-white	6.
6.	Forewings with inner margin suffused with red	20. *argyrographus* ♀.
	Forewings with inner margin not suffused with red	7.
7.	Hindwings with apex greenish..........	19. *scriptus* ♀.
	Hindwings with apex not greenish.....	18. *Ramsayi* ♀.
8.	Forewings with white costal streak.....	9.
	Forewings without white costal streak	11.
9.	Forewings with three white fasciæ......	16. *splendens* ♂.
	Forewings with one white fascia........	10.

10. Forewings with two white streaks from inner margin before middle .... 14. *Lewinii* ♂.
Forewings with one white streak from inner margin before middle........... 15. *lignivorus* ♂.
11. Forewings with a posterior golden fascia ....21. *eximius* ♂.
Forewings without a posterior golden fascia .... 12.
12. Forewings with one posterior white fascia .... 18. *Ramsayi* ♂.
Forewings with four posterior white fasciæ .... 19. *scriptus* ♂.

14. *Hep. Lewinii*, Walk.

(*Charagia Lewinii*, Walk. Bomb. 1570; Scott, Trans. Ent. Soc. N.S. Wales, II. 30; *C. Lamberti*, Walk. Bomb. 1571.)

♂. 44 mm. Head and thorax green. Forewings green; markings silvery-white; a streak along costa from base to $\frac{3}{4}$; a slender nearly perpendicular streak from inner margin at $\frac{1}{5}$, reaching half across wing; a similar streak near beyond it, from apex of which proceeds a streak (forming an acute angle with it) to $\frac{2}{3}$ of inner margin, where it meets a straight slender transverse streak from $\frac{3}{4}$ of costa. Hindwings greenish-whitish.

♀. 58 mm. Head and thorax dark fuscous-red. Forewings fuscous-reddish; a rather broad irregular green band from disc near base to near inner margin in middle, where it forms an acute angle, thence bent up to beneath costa at $\frac{3}{5}$; a small green spot towards hindmargin in middle, sometimes connected with this band. Hindwings ochreous-rosy.

Sydney, New South Wales; rather common. Larva on *Casuarina* and other trees.

15. *Hep. lignivorus*, Lw.

(*Hepialus lignivora*, Lw. Ins. N. S. Wales, pl. 16; *Charagia lignivora*, Scott, Austr. Lep. 5, pl. ii. Trans. Ent. Soc. N. S. Wales, II. 29.)

♂. 40-48 mm. Head whitish. Antennæ reddish-ochreous. Thorax green, anterior margin and posterior crest white. Forewings elongate-triangular, costa sinuate, posterior moderately arched, apex round-pointed, hindmargin oblique, rather strongly sinuate inwards on upper half, rounded beneath tolerably continuously with inner margin; green; a white streak along costa from base to $\frac{3}{4}$, broad at base, attenuated throughout; a white outwardly oblique streak from inner margin at $\frac{1}{5}$, reaching half across wing; a white inwardly oblique streak from inner margin beyond middle, its apex almost or quite touching apex of preceding streak; a slender somewhat sinuate white fascia from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, where it is sometimes confluent with preceding streak. Hindwings white.

♀. 50-66 mm. Head, antennæ, and thorax rather dark fuscous. Forewings rather dark fuscous, somewhat mixed with reddish; markings bright green; a very large triangular blotch in disc anteriorly, its angles lying beneath costa near base, beneath costa at $\frac{2}{3}$, and very near inner margin beyond middle; sometimes one or two small spots near inner margin before middle; an irregular suboblong blotch along hindmargin from apex to below middle, connected with anterior blotch by a bar in disc. Hindwings ochreous-rosy, more ochreous posteriorly; hindmargin narrowly suffused with dark fuscous from below middle to middle of inner margin.

Newcastle and Sydney, New South Wales; Fernshaw, Victoria; Hobart, Tasmania; Mount Lofty, South Australia; common. Larva on various trees and shrubs.

16. *Hep. splendens*, Scott.

(*Charagia splendens*, Scott, Trans. Ent. Soc. N. S. Wales, II. 31.)

♂. 60 mm. Forewings yellowish-green, posteriorly bluish-green; markings silvery-white; a streak along costa from base to $\frac{2}{3}$, thence to inner margin beyond middle, thence towards base, before reaching which it forms two distinct angles; two narrow

posterior transverse fasciae, connected at upper extremity; a bluish-green V-shaped mark in centre of disc. Hindwings greenish-white.

♀. 80 mm. Forewings purple; markings green; a large triangular discal blotch, lower angle touching inner margin, upper side thrice indented towards base; a blotch towards apex, extending half across wing, indented on anterior side; a spot near anal angle, and two near base. Hindwings pale purplish-red.

Sydney, New South Wales. Larva on *Casuarina* and other trees. I have not seen this species, and have drawn up the description from Scott's.

17. *Hep. Scotti*, Scott.

(*Charagia Scotti*, Scott, Trans. Ent. Soc. N. S. Wales, II. 34.)

♀. 112 mm. Forewings green, strewn with small purplish-brown spots; a slender purplish-brown posterior fascia. Hindwings yellowish-red.

Richmond River, New South Wales. Larva on *Wistaria*, &c. The above is taken from Scott's description.

18. *Hep. Ramsayi*, Scott.

(*Charagia Ramsayi*, Scott, Trans. Ent. Soc. N. S. Wales, II. 32.)

♂. 84-100 mm. Head and thorax green. Forewings green; markings silvery-white, sometimes reddish-tinged, fuscous-margined; four small spots on anterior half of costa, one towards base in middle, one on inner margin near base, one below disc at $\frac{1}{3}$, and a transverse series of four transverse narrow spots, bisected by veins, at $\frac{2}{3}$; one or two small spots on hind-margin. Hindwings whitish-green.

♀. 137 mm. Forewings green; markings silvery-white, margined with dark fuscous, placed as in ♂ but larger. Hindwings yellowish-red.

Newcastle, New South Wales. Larva on *Acmena*, &c.

19. *Hep. scriptus*, Scott.

(*Charagia scripta*, Scott, Trans. Ent. Soc. N.S. Wales, II. 33.)

♂. 75 mm. Forewings green, posteriorly yellowish-tinged, watered with paler; four posterior silvery-white fasciæ; anterior half strewn with short silvery-white marks. Hindwings greenish-white.

♀. 100 mm. Forewings green, watered with paler; costa strigulated with silvery-white; a discal silvery-white spot; two posterior series of silvery-white spots. Hindwings yellowish-red, tips greenish.

Albany, West Australia. I have not seen it; description taken from Scott's.

20. *Hep. argyrographus*, Feld.

(*Charagia argyrographa*, Feld. pl. LXXXI. 2.)

♀. 84 mm. Forewings green, towards inner margin suffused with reddish; costa spotted with dark grey and whitish; numerous small scattered paler marks; two posterior series of white spots, and a hindmarginal series. Hindwings deep ochreous-yellow, suffused with reddish towards base.

No special locality quoted. I have not seen the species, and have described Felder's figure.

21. *Hep. eximius*, Scott.

(*Charagia eximia*, Scott, Trans. Ent. Soc. N.S. Wales, II. 35.)

♂. 75-110 mm. (?) Forewings green, watered with numerous short silvery-white marks; a posterior golden fascia not reaching either margin. Hindwings pale blue-green.

Newcastle, New South Wales. Larva on *Dodonaea angustifolia*. Unknown to me; description from Scott.

6. LETO, Hb.

Antennæ $\frac{1}{10}$, in ♂ simple. Palpi moderate, porrected, smooth-scaled. Forewings with vein 7 from angle, 8 from before angle, 9 and 10 stalked. Hindwings in ♂ with upper surface partially tufted with long rough hairs; neuration as in forewings.

Besides the following, there is one South African species, of almost equal size and splendour. There is no doubt of the generic identity of these two forms, which agree in all structural characters, and are specially distinguished by the shaggy tufts of the hindwings in the ♂, being at the same time the largest and most magnificent of the family. The instance of near affinity between Australian and South African forms in the *Lepidoptera* are by no means numerous, and this is an interesting case.

22. *Let. Stacyi*, Scott.

(*Zelotypia Stacyi*, Scott, Trans. Ent. Soc. N.S. Wales, II. 38.)

♂♀. 175-220 mm. Forewings greenish-ochreous; costal area strewn with ferruginous spots, surrounded by ochreous-whitish rings; hindmarginal area watered with ferruginous and whitish lines; some small black spots on costa towards apex and on hindmargin; a large raised roundish deep ochreous spot beyond middle, containing a central black crescentic mark, and a round pale ochreous white-circled anterior spot; in ♂ two or three cloudy whitish blotches on costa, one in disc before middle, and a narrow irregular fascia at $\frac{3}{4}$. Hindwings deep ferruginous-orange.

Newcastle and Manning River, New South Wales. The larva feeds in the trunks of trees. It seems to me not improbable that the colouring of the perfect insect is designed to imitate the head of a snake; this might be determined by those who have the opportunity of seeing the insect alive in its natural position of repose.

7. Pielus, Walk.

Antennæ $\frac{1}{4}$-$\frac{1}{5}$, in ♂ unipectinated throughout, pectinations broad, lamellate. Palpi short, basal joint somewhat rough-scaled beneath, second and terminal joints smooth, terminal joint nearly as long as second, subclavate. Posterior tibiæ with long rough projecting hairs. Forewings with vein 7 from angle, 8 from much before angle, 9 and 10 stalked from near 8. Hindwings as in forewings.

Forewings unicolorous..................... 23. *ingens*.
Forewings variously marked............. 24. *hyalinatus*.

23. *Piel. ingens*, Walk.

(*Charagia ingens*, Walk. Suppl. 596; *Pielus erythrinus*, ib. 599.)

♂. 137-156 mm. Head, thorax, and abdomen pale brownish-ochreous; abdomen sometimes suffused with very pale rosy except towards apex. Antennæ dark fuscous, pectinations 1½. Forewings elongate, subtriangular, costa gently arched, apex obtuse, hindmargin extremely obliquely rounded continuously with inner margin, not sinuate; unicolorous pale brownish-ochreous or ochreous-reddish. Hindwings pale brownish-ochreous or yellowish-ochreous, towards base sometimes suffused with very pale rosy.

Fernshaw, Victoria; four specimens. This species has been alleged to occur in New Zealand, but I believe by a simple error.

24. *Piel. hyalinatus*, HS.

(*Hepialus hyalinatus*, HS. Lep. Exot. I. 50; *Pielus hyalinatus*, Walk. Bomb. 1576; *P. tasmaniæ*, ib. 1577; *Rhizopsyche Swainsoni*, Scott, Austr. Lep. 11. pl. IV.; *Pielus imperialis*, Olliff, Proc. Linn. Soc. N.S. Wales, 1887, 1015, pl. XXXIX.)

♂♀. 80-165. Head and thorax brown, sometimes reddish or ochreous-tinged, crown and posterior part of thorax sometimes suffused with whitish-ochreous. Antennæ dark fuscous, pectinations 2. Forewings elongate, subtriangular, costa gently arched, apex obtuse, hindmargin very oblique, gently rounded continuously with inner margin; brown or light brownish-ochreous, irregularly marked with parallel labyrinthine paler or whitish lines, alternating with dark fuscous or blackish, tending to enclose irregular darker sometimes whitish-centred spots, especially in disc between discal and posterior streaks, very variable, sometimes more or less wholly obsolete; a very irregular rather broad white longitudinal streak in disc from near base to ⅔, sometimes hardly paler than ground colour, sometimes variously interrupted, or extended to connect with posterior streak; a similar oblique streak from apex to above anal angle, similarly very variable: cilia rather dark fuscous. Hindwings pale grey, light brownish-ochreous, fuscous, or dark grey, base sometimes considerably darker.

var. *a*. Base of hindwings and of abdomen rosy.

var. *β*. Forewings and hindwings rosy-ochreous; streaks silvery-white, broadly margined with fuscous; labyrinthine marks obsolete.

Newcastle and Blackheath, New South Wales; Melbourne, Warragul, and Fernshaw, Victoria; fifteen specimens. The larva feeds underground on the roots of trees. The imago is exceedingly variable, no two being alike.

8. Trictena, n.g.

Antennæ $\frac{1}{3}$, in ♂ tripectinated throughout. Palpi moderate, straight, porrected, basal joint shortly rough-scaled beneath, second and third terminal joints smooth, terminal joint half second, clavate. Posterior tibiæ densely rough-haired. Forewings with vein 7 from angle, 8 from much before angle, 9 and 10 stalked from near 8. Hindwings as in forewings.

Characterised by the singular tripectinate antennæ, which are, so far as I know, unique. The imago is of ponderous build; it may be regarded as a development of the preceding genus.

25. *Trict. labyrinthica*, Don.

(*Cossus labyrinthicus*, Don. Ins. N. Holl.; *C. argenteus*, ib., HS. Lep. Exot. I. 47, 48; *Pielus labyrinthicus*, Walk. Bomb. 1578; *P. atripalpis*, ib. 1577; *P. hydrographus*, Feld. pl. LXXX. 3.)

♂♀. 100-188 mm. Head, thorax, and abdomen dark fuscous. Antennæ light ferruginous. Forewings elongate-triangular, costa posteriorly moderately arched, apex obtuse, hindmargin oblique, slightly sinuate, rounded beneath continuously with inner margin; dark fuscous, more or less marked with irregular parallel lighter and darker labyrinthine lines, tending to enclose irregular concentric rings, especially towards hindmargin, where they are sometimes whitish-centered; a very irregular-edged rather broad white longitudinal streak in disc from near base to before $\frac{2}{3}$, posteriorly generally emitting three or four short teeth; sometimes several small scattered white spots in disc beyond apex of this; a slightly

sinuate rather irregular white streak from apex, or close beneath it, to midway between apex of discal streak and anal angle, more or less dilated in middle, lower portion sometimes interrupted to form two or three spots; in ♀ all white markings are much reduced or entirely absent: cilia dark fuscous. Hindwings fuscous; cilia dark fuscous.

Sydney, New South Wales; in April and May, sometimes common at gas-lamps. Larva subterranean, feeding on the roots of trees, sometimes at a considerable depth; it was eaten for food by the natives.

MONOCTENIADAE.

No maxillary palpi. Forewings with vein 1 simple, 5 rising from transverse vein not nearer to 4 than to 6, 7 and 8 out of 9. Hindwings with vein 1c absent; 5 from middle of transverse vein, 8 closely approximated to upper margin of cell from near base to middle of cell or beyond, rarely fused with it at a point near base, or (*Hypographa*) anastomosing with margin of cell.

This family I have elsewhere called *Oenochromidae*, but as the genus *Oenochroma* proves on examination to be non-existent, being only a synonym of *Monoctenia*, I consider it necessary to change the name accordingly. The family belongs to the *Geometrina*, and is of great interest as being apparently the most ancestral section of that group. With the *Larentiadae* and *Boarmiadae* it cannot be confused structurally (see however *Hypographa*); with the *Geometridae* and *Desmobathridae* also no difficulty can arise except in the case of those exceptional genera in which vein 8 of the hindwings is fused with the cell at a point near base; from these the *Geometridae* differ in that vein 8 after fusion immediately diverges rapidly from the cell, whilst in the *Monocteniadae* it continues close to it and approximately parallel; in the *Desmobathridae* vein 8 is not fused with the cell-margin but connected with it by a well-marked and distinct bar, but no doubt the genetic relation here runs close, the two families being really united developmentally through these very genera or others nearly

related. The *Larentiadae* are without doubt derived directly from the *Monocteniadae*, originating from a type closely resembling *Dichromodes*, by strong anastomosis of vein 8 in the hindwings with the cell-margin. The *Desmobathridae* may also be certainly regarded as springing from a form nearly allied to *Xenomusa*. The *Geometridae* and *Boarmiadae* appear to me at present to be derived from a common ancestor approaching *Aspilates*, but the actual line of connection is not yet quite clearly made out.

Within the limits of the family there is considerable variation in superficial characteristics, some of the earlier genera being very Bombyciform in appearance. An interesting structural character which is very common in this family and very unusual in any other is found in the uniserial pectinations of the antennæ; nearly three-fourths of the species of *Monocteniadae*, including the most dissimilar groups, show this character, which appears elsewhere in the *Lepidoptera* only in isolated instances. The larvæ are at present little known; but some, at least, have twelve perfect legs instead of ten, and moreover possess rudiments of the other two pairs; this is what one might expect in an ancestral group, and it would not surprise me if larvæ of this family were hereafter found with the full complement of sixteen perfect legs.

The geographical distribution of the family shows very markedly the usual features of an ancient group, struggling with difficulty to maintain itself against numerous newer and improved forms. There are a certain number of small, scattered, and fragmentary genera, occurring almost at random throughout the old world, and nowhere dominant; and there is also a specially developed later group (that of *Taxeotis* and *Dichromodes*) practically confined to Australia, originating there under the protection of a situation which probably long excluded dangerous competitors, and hence much better represented in number of species. I conceive that the immediate ancestors of the *Dichromodes* group, residing probably in Southern Asia, gave rise to two separate branches of descent, one being the *Dichromodes* group, which arose within Australia from emigrants who made their way thither; and the

other the *Larentiadae*, which rapidly became a dominant type in Asia and Europe and spread thence over all the world, making their way also to Australia at a later period; here they have flourished as elsewhere, but the *Dichromodes* group found itself already so well established and adapted to its situation, that it has apparently not suffered much from their competition, though not strong enough to retaliate by invading the enemy's country, except that it has contrived to settle a very small colony in the mountains of New Zealand. I think this is a clear and interesting case.

In the following tabulation of genera I have included not only the Australian genera, but all those from other regions with which I am acquainted by actual observations, as it will help to give an idea of the range of the family, which has been hitherto unrecognised. *Brephos*, for example, has been usually classed with the *Noctuina* (though Lederer showed that it could not remain there and constituted a separate family for it), and the others have been distributed at random in various groups. The Australian genera are numbered in succession; the others are distinguished by letters attached to the number of the genus immediately preceding them, which serve to show their position in sequence.

1.	Hindwings with vein 8 fused with cell at a point near base	2.
	Hindwings with vein 8 free or rarely anastomosing with cell strongly..................	3.
2.	Face and palpi clothed with very long rough hairs	7a. *Brephos.*
	Face and palpi not hairy........................	10. *Xenomusa.*
3.	Antennæ in ♂ pectinated	4.
	Antennæ in ♂ ciliated	17.
4.	Antennæ in ♂ unipectinated	5.
	Antennæ in ♂ bipectinated.	9.
5.	Forewings with vein 10 out of 9	4. *Satraparchis.*
	Forewings with vein 10 rising separate......	6.

6. Forewings with vein 11 anastomosing with 12 ....16. *Hypographa.*
Forewings with vein 11 not anastomosing with 12 .... 7.
7. Forewings with vein 11 anastomosing with 10 .... 5. *Epidesmia.*
Forewings with vein 11 free .... 8.
8. Tarsi spinulose ....15. *Monoctenia.*
Tarsi not spinulose .... 6. *Dichromodes.*
9. Forewings with vein 11 connected with 12.. 11.
Forewings with vein 11 not connected with 12 .... 10.
10. Forewings with vein 10 absent.. ....7b. *Eremia.*
Forewings with vein 10 present .... 12.
11. Forewings with vein 10 anastomosing with 11 .... 2. *Darantasia.*
Forewings with vein 10 free ....11. *Onychodes.*
12. Forewings with vein 10 anastomosing with 11 .... 13.
Forewings with vein 10 not anastomosing with 11 .... 14.
13. Antennal pectinations short, terminating in tufts of long cilia ....7f. *Theoxena.*
Antennal pectinations normal.................... 3. *Nearcha.*
14. Tarsi spinulose ....14. *Phallaria.*
Tarsi not spinulose .... 15.
15. Posterior tibiæ without middle-spurs ....12. *Arrhodia.*
Posterior tibiæ with middle-spurs .... 16.
16. Forewings with vein 6 out of 9.. ....13. *Gastrophora.*
Forewings with vein 6 separate... .... 8. *Aspilates.*
17. Antennæ nearly as long as forewings.................... 9. *Eumelia.*
Antennæ normal .... 18.

18. Forewings with vein 11 free .... 7. *Oenone.*
    Forewings with vein 11 not free .... 19.
19. Hindwings with 6 and 7 stalked .... 20.
    Hindwings with veins 6 and 7 separate...... 21.
20. Forewings with vein 10 absent ....7c. *Aplasta.*
    Forewings with vein 10 present...............7d. *Odezia.*
21. Forewings with vein 11 out of 10...........7e. *Gypsochroa.*
    Forewings with vein 11 separate.............. 1. *Taxeotis.*

1. Taxeotis, n.g.

Face smooth. Tongue developed. Antennæ in ♂ filiform or subdentate, moderately ciliated ($\frac{3}{4}$-1). Palpi moderate or rather long, porrected, rough-scaled. Forewings with vein 10 anastomosing with 9, 11 anastomosing strongly with 10 before 9, 12 sometimes connected by bar with 11. Hindwings with veins 6 and 7 approximated at base.

An endemic development from *Epidesmia.* The species are commonly very difficult to distinguish, being obscurely coloured, extremely similar, and at the same time variable; I believe however that I have correctly defined the limits of those given, though I make no doubt that there are other closely allied forms which I have overlooked or not met with.

1. Forewings without discal dot................. 13. *philodora.*
   Forewings with discal dot..................... 2.
2. Forewings with discal dot spot-like, pale-centred .... 2. *stereospila.*
   Forewings with discal dot not spot-like, pale-centred .... 3.
3. Forewings with two triangular black spots on costa.................................. 4. *isomeris.*
   Forewings without two triangular black spots on costa................................ 4.

4. Face ferruginous .... 5.
   Face dark fuscous (sometimes ferruginous-tinged) or black........................ ..... 6.
5. Forewings with first line marked by a ferruginous black-spotted streak......... 5. *exsectaria.*
   Forewings with first line obsolete .... 1. *endela.*
6. Forewings with costal edge ochreous-yellowish anteriorly................. ..... 6. *anthracopa.*
   Forewings with costal edge not ochreous-yellowish anteriorly .... 7.
7. Base of palpi sharply whitish .... 8.
   Base of palpi not sharply whitish........... 12.
8. Forewings with second line ferruginous or ochreous-tinged............................ 9.
   Forewings with second line not ferruginous or ochreous-tinged......................... 10.
9. Forewings with a sharply marked dark line in cilia .... 7. *delogramma.*
   Forewings without a sharply marked dark line in cilia... .... 8. *intextata.*
10. Forewings with a subterminal series of darker spots....... .... 11.
    Forewings without a subterminal series of darker spots .... 10. *intermixtaria.*
11. Forewings grey................................ 12. *isophanes.*
    Forewings ochreous-whitish.................. 11. *epigypsa.*
12. Forewings with hindmargin on upper half sinuate .... 9. *egenata.*
    Forewings with hindmargin on upper half straight .. .. 3. *oraula.*

In the first three species vein 12 of the forewings is free, in all the others it is connected by bar with 11. This character is constant in my specimens, but is perhaps not altogether reliable, and too much stress should not be laid on it.

1. *Tax. endela*, n.sp.

♂. 22-28 mm. Head ochreous-whitish, face light ferruginous. Palpi 2, light ferruginous, base ochreous-whitish. Antennæ whitish. Thorax, abdomen, and legs pale whitish-ochreous. Forewings triangular, hindmargin straight above, rounded beneath; 12 free; whitish-ochreous, with some fine scattered dark fuscous scales; a dark fuscous dot in disc above middle; a nearly straight or faintly sinuate series of about seven blackish dots from $\frac{3}{4}$ of inner margin towards apex, only reaching $\frac{3}{4}$ across wing, sometimes edged posteriorly by a slender faint ochreous streak; a fine blackish interrupted hindmarginal line or series of dots: cilia whitish-ochreous. Hindwings with hindmargin rounded; whitish-ochreous, generally with fine scattered dark fuscous scales; hindmarginal line and cilia as in forewings.

Bathurst (2500 feet), New South Wales; Melbourne, Victoria; in November and December, four specimens. A distinct species, well characterised by the pale ferruginous face and palpi, whitish-ochreous colouring, total absence of first line of forewings, and straightness of second.

2. *Tax. stereospila*, n.sp.

♂♀. 21-24 mm. Head pale whitish-ochreous, face rather dark fuscous except lower margin. Palpi $2\frac{1}{2}$-3, whitish-ochreous, externally more or less brownish-tinged. Antennæ ochreous-whitish. Thorax whitish-ochreous. Abdomen ochreous-whitish, sprinkled with blackish. Legs whitish-ochreous irrorated with blackish, tarsal joints blackish towards base. Forewings triangular, hindmargin on upper half in ♂ almost straight, in ♀ sinuate, rounded beneath; 12 free; whitish-ochreous, irrorated with fuscous and black; a small dark fuscous mark on costa at $\frac{1}{3}$, a dot on inner margin at $\frac{1}{3}$, and one or two dots in a straight line between them; a small transverse-oblong fuscous or blackish spot in disc above middle, centred with paler scales; a small dark fuscous mark on costa at $\frac{3}{4}$; a cloudy dark fuscous line from apex to inner margin at $\frac{3}{4}$, sinuate inwards on upper half and again on lower half, on lower $\frac{3}{4}$ closely preceded by a ferruginous sometimes interrupted

line, marked in ♂ with black dots on veins, and closely followed by a series of cloudy blackish dots; a hindmarginal series of black dots: cilia whitish-ochreous, basal half in ♀ irrorated with dark fuscous. Hindwings with hindmargin rounded; pale whitish-ochreous, irrorated with fuscous and blackish; a short double dark fuscous line rising from inner margin at $\frac{2}{3}$; hindmarginal dots and cilia as in forewings.

Sydney and Bathurst (2500 feet), New South Wales, in October and November; common. Distinguished from all others by the small dark pale-centered spot replacing the usual discal dot of forewings.

3. *Tax. oraula*, n.sp.

♂. 21-22 mm. Head grey-whitish, face dark fuscous. Palpi $1\frac{1}{2}$, dark fuscous. Antennæ grey-whitish. Thorax and abdomen whitish-grey. Legs grey, posterior tibiæ grey-whitish. Forewings triangular, hindmargin straight above, rounded beneath; 12 free; pale grey, sprinkled with dark fuscous; a short dark fuscous mark on costa at $\frac{2}{5}$, one on inner margin at $\frac{2}{5}$, and a dot in disc directly between these; a minute dark fuscous dot in disc above middle; a dark fuscous mark on costa at $\frac{3}{4}$; a series of dark fuscous dots from near beyond lower extremity of this to $\frac{3}{4}$ of inner margin, rather strongly sinuate inwards on lower half, the whole sometimes connected by a fine denticulate dark fuscous line, acutely angulated at upper extremity to connect with costal mark; a very faintly indicated paler waved subterminal line; a hindmarginal series of black dots: cilia pale grey. Hindwings with hindmargin rounded; pale grey; a short indistinct dark fuscous erect line from $\frac{2}{3}$ of inner margin; a hindmarginal series of dark fuscous dots; cilia pale grey.

Mount Kosciusko (5000-5800 feet), New South Wales, in January; two specimens. Besides the neural character, it differs from all the other similar species with dark fuscous palpi, except *T. egenata*, in not having the sharply-defined white basal area of palpi; from *T. egenata* it is readily separated by the smaller size, straight upper portion of hindmargin of forewings, dark fuscous costal marks, absence of subterminal spots, and other details.

4. *Tax. isomeris*, n.sp.

♂. 19 mm. Head grey sprinkled with white, face black. Palpi $1\frac{2}{3}$, black. Antennæ grey. Thorax pale ochreous-grey. Abdomen whitish-grey. Legs dark grey, posterior pair irrorated with paler. Forewings triangular, hindmargin straight above, rounded beneath; 12 connected by bar with 11; grey, suffusedly irrorated with light greyish-ochreous, especially towards costa; costa shortly and suffusedly strigulated with dark grey; two small triangular blackish spots on costa at $\frac{2}{5}$ and $\frac{2}{3}$; a short mark of mixed blackish and ochreous scales on inner margin at $\frac{1}{3}$, and a dot between this and first costal spot; a moderate outwards-curved series of similar dots from second costal spot to a short mark on inner margin at $\frac{3}{4}$, slightly sinuate inwards on lower third; a rather large black dot in disc above middle; faint traces of a paler waved subterminal line; a hindmarginal series of black dots: cilia grey irrorated with black. Hindwings with hindmargin rounded; grey; a darker discal dot; a short cloudy dark grey mark on inner margin at $\frac{2}{3}$, with faint indications of a continuous transverse line; hindmarginal dots and cilia as in forewings, but more obscure.

Albany, West Australia, in December; one specimen. This species is very well characterised by the triangular black costal spots.

5. *Tax. exsectaria*, Walk.

(*Panagra exsectaria*, Walk. 1011.)

♂♀. 17-21 mm. Head ochreous-whitish, more or less ferruginous-tinged, face ferruginous, back of crown grey. Palpi 2, ferruginous, base whitish. Antennæ pale grey. Thorax light ashy-grey, sometimes with a few black scales. Abdomen whitish-grey. Legs rather dark fuscous, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin slightly sinuate on upper half, rounded beneath; 12 connected by bar with 11; grey, finely irrorated with ashy-whitish, and sometimes with a few black scales, in ♀ more or less suffusedly irrorated with brownish on

median area; a small blackish-grey spot on costa at $\frac{1}{3}$, and another at $\frac{3}{4}$; a slender almost straight ferruginous streak from beneath first costal spot to $\frac{1}{3}$ of inner margin, marked with a cloudy black dot in disc and two towards inner margin; a moderate blackish dot in disc above middle; a sinuate ferruginous line, marked with blackish dots, from near beneath and beyond second costal spot to inner margin at $\frac{3}{4}$, followed by a more or less marked cloudy dark grey shade, separated from it by a fine pale line; generally a subterminal series of cloudy blackish dots, sometimes obsolete, in ♀ followed by a denticulate pale line; a hindmarginal series of black dots: cilia light grey. Hindwings with hindmargin rounded; light grey, in ♀ irrorated with dark fuscous; a dark fuscous discal dot, sometimes indistinct; a more or less marked slightly sinuate dark grey line at $\frac{2}{3}$, more distinct towards inner margin, sometimes almost obsolete; in ♀ subterminal dots and line as in forewings, but more obscure; a hindmarginal series of black dots; cilia light grey.

Sydney and Bathurst (2500 feet), New South Wales; Adelaide, South Australia; York, Perth, and Albany, West Australia; from September to December, common. Readily recognisable by the small size and neat appearance, the well-marked ferruginous first line, and especially the ferruginous colouring of the head.

6. *Tax. anthracopa*, n.sp.

♂. 21-23 mm. Head grey, sometimes becoming whitish-ochreous anteriorly, face black. Palpi $1\frac{2}{3}$, blackish, towards base white beneath. Antennæ and thorax grey. Abdomen whitish-grey, sprinkled with blackish. Legs dark grey, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin almost straight above, rounded beneath; 12 connected bybar with 11; grey, finely sprinkled with black; costal edge slenderly ochreous-yellowish anteriorly; a very obscure darker mark on costa at $\frac{2}{5}$, one on inner margin at $\frac{2}{5}$, and a dot in disc between these; a moderate blackish dot in disc above middle; an obscure darker mark on costa at $\frac{3}{4}$; a sinuate series of blackish dots, posteriorly obscurely margined with paler, from beneath and

slightly beyond this to inner margin at $\frac{3}{4}$, sometimes followed by an obscure darker grey shade towards inner margin; a subterminal series of small cloudy blackish spots, sometimes reduced to dots; a hindmarginal series of black dots: cilia with basal half light grey sprinkled with black, terminal half grey-whitish. Hindwings with hindmargin rounded; colour, hindmarginal dots, and cilia as in forewings; a blackish discal dot; an indistinct sinuate darker line at $\frac{3}{5}$, obscurely margined posteriorly with paler; a subterminal series of small darker spots obscurely defined, sometimes obsolete.

Sydney, New South Wales; Deloraine, Tasmania; in September and December, four specimens. Differs from all the species with black and white palpi by the yellowish costal edge of forewings; characterised also by the absence of ferruginous lines, and comparative shortness of palpi.

7. *Tax. delogramma*, n.sp.

♂♀. 20-24 mm. Head ochreous-whitish, face dark fuscous. Palpi 2, dark fuscous, white towards base. Antennæ whitish spotted with fuscous. Thorax whitish-grey. Abdomen very pale greyish-ochreous, sprinkled with black. Legs pale brownish-ochreous, femora and posterior tibiæ whitish-ochreous irrorated with dark fuscous. Forewings triangular, hindmargin in ♂ faintly, in ♀ distinctly sinuate above, rounded beneath; 12 connected by bar with 11; pale greyish-ochreous, sprinkled with black; a dark fuscous dot on costa about $\frac{1}{5}$, another on inner margin at $\frac{1}{3}$, and two between these; a moderate blackish dot in disc above middle; a short dark fuscous mark on costa at $\frac{3}{4}$; an ill-defined sinuate ferruginous line, marked with blackish dots, from beneath and beyond this to inner margin at $\frac{3}{4}$, often followed by a cloudy rather dark fuscous shade; beyond this a subterminal series of small cloudy blackish spots or dots, posteriorly margined by paler marks, and sometimes followed by short dark streaks on veins; a hindmarginal series of black dots: cilia ochreous-whitish, basal half sprinkled and sometimes obscurely barred with dark fuscous, separated by a well-defined dark fuscous median line, becoming

lighter towards anal angle. Hindwings with hindmargin rounded; colour, hindmarginal dots, and cilia as in forewings; a dark fuscous discal dot; a rather irregularly sinuate more or less indistinct darker line at $\frac{2}{3}$, often marked with a series of blackish dots, sometimes margined posteriorly by a fine pale line.

Duaringa, Queensland; Sydney, Blackheath (3500 feet), and Bathurst (2500 feet), New South Wales; Melbourne and Beechworth, Victoria; Deloraine and Georges Bay, Tasmania; Mount Lofty, South Australia; York and Albany, West Australia; from October to January, common everywhere. This common species appears to have been hitherto confused with the next, and to have received no distinctive name; its special character is the strongly-marked dark line of the cilia, but it may also be separated from *T. intextata* by the dark fuscous (not ferruginous-tinged) palpi, and the straighter hindmargin of forewings in ♂.

8. *Tax. intextata*, Gn.

(*Panagra intextata*, Gn. X. 130; *P. perlinearia*, Walk. 998; *P. areniferata*, ib. 998; *P. explicataria*, ib. 999; *P. inconcisata*, ib. 1003.)

♂♀. 22-28 mm. Head whitish-ochreous, face deep ferruginous-fuscous. Palpi 2, deep ferruginous, base ochreous-whitish. Antennæ ochreous-whitish. Thorax and abdomen pale greyish-ochreous sprinkled with black. Legs light brownish-ochreous, femora and posterior tibiæ whitish-ochreous sprinkled with dark fuscous. Forewings triangular, hindmargin above distinctly sinuate in both sexes, rounded beneath; pale greyish-ochreous or grey-brownish, sprinkled with black, in ♀ more brownish or sometimes yellow-ochreous; a very faint ochreous line from $\frac{1}{3}$ of costa to $\frac{1}{3}$ of inner margin, posterior edge often marked with three or four dark fuscous dots; a moderate blackish dot in disc above middle; a cloudy dark fuscous mark on costa at $\frac{3}{4}$; a sinuate yellowish-ochreous line or cloudy streak from beyond and beneath this to inner margin at $\frac{3}{4}$, marked with a series of dark fuscous dots sometimes connected by a fuscous line; a subterminal series of small blackish spots, in ♀ obscure or obsolete; a hind-

marginal series of black dots: cilia whitish-fuscous, whitish-ochreous, or grey-whitish, base sometimes with a few scattered dark fuscous scales. Hindwings with hindmargin rounded; colour, hindmarginal dots, and cilia as in forewings; a dark fuscous discal dot; a nearly straight often indistinct pale ochreous line or streak at $\frac{2}{3}$, marked with a series of dark fuscous dots or fuscous line.

Toowoomba (2000 feet), Queensland; Sydney, New South Wales; Mount Lofty, South Australia; from August to December, very common. Differs from all the nearest-allied species by the very deep ferruginous palpi; in colouring it is otherwise very variable. Under the head of *P. inconcisata,* Walker has included with this species specimens also of the preceding; it is also likely enough that Guénée's description refers to both; but as neither of these makes any mention of the conspicuous dark line in the cilia which characterises *T. delogramma,* I refer these descriptions to this species.

9. *Tax. egenata,* Walk.

(*Panagra egenata,* Walk. 997.)

♂. 28 mm. Head grey-whitish, face blackish. Palpi $1\frac{2}{3}$, dark fuscous, base mixed with paler. Antennæ whitish. Thorax and abdomen whitish-grey, with a few black scales. Legs pale grey, femora and posterior tibiæ sprinkled with blackish. Forewings triangular, hindmargin sinuate above, rounded beneath; 12 connected by bar with 11; pale ochreous-grey, sprinkled with fine black scales; a blackish dot in disc at $\frac{1}{4}$, and one near inner margin at $\frac{1}{3}$; a moderate blackish dot in disc above middle; a nearly straight fine obscure ochreous-whitish line from towards costa at $\frac{4}{5}$ to inner margin at $\frac{3}{4}$, margined anteriorly by a series of blackish dots; a subterminal series of blackish dots, two lowest sometimes confluent into an irregular spot; a hindmarginal series of black dots: cilia fuscous-whitish, basal half somewhat sprinkled with fuscous, with a light fuscous median line. Hindwings with hindmargin rounded; colour, hindmarginal dots, and cilia as in forewings; a blackish discal dot; a gently-curved fine obscure ochreous-whitish line at $\frac{2}{3}$, anteriorly margined with a series of blackish dots.

Duaringa, Queensland, in July; three specimens received from Mr. G. Barnard. Separable from the similar species with dark fuscous palpi, except *T. oraula*, by their not having the base sharply white; from *T. oraula* by the sinuate hindmargin of forewings, difference in neuration, and other characters noted above.

10. *Tax. intermixtaria*, Walk.

(*Panagra intermixtaria*, Walk. 1000; *P. promelanaria*, ib. 1666.)

♂. 24-25 mm. Head ochreous-white, face dark fuscous. Palpi 2, dark fuscous, base white. Antennæ whitish. Thorax and abdomen grey-whitish. Legs light grey, femora and posterior tibiæ whitish sprinkled with dark grey. Forewings triangular, hindmargin straight above, rounded beneath; 12 connected by bar with 11; pale whitish-grey, suffusedly irrorated with ochreous-whitish, and with fine scattered black scales; a black dot in disc at $\frac{1}{3}$, and another above inner margin at $\frac{2}{5}$; a black dot above middle of disc; a black dot on costa at $\frac{3}{4}$; a sinuate series of black dots from beneath and rather beyond this to $\frac{3}{4}$ of inner margin; a hindmarginal series of black dots: cilia whitish-grey, terminal half whitish, dividing line grey, distinct. Hindwings with hindmargin rounded; colour, hindmarginal dots, and cilia as in forewings; a blackish discal dot; a somewhat sinuate series of very indistinct darker dots at $\frac{2}{3}$, followed by traces of a paler line.

Bathurst (2500 feet), New South Wales, in November; three specimens. Characterised by the pale colouring, absence of ochreous markings and of subterminal spots, and presence of distinct line in cilia.

11. *Tax. epigypsa*, n.sp.

♂. 20 mm. Head, antennæ, thorax, abdomen, and legs whitish; face blackish. Palpi $1\frac{2}{3}$, blackish, base white. Forewings rather elongate-triangular, hindmargin straight above, rounded beneath; 12 connected at a point with 11; ochreous-whitish, with a few fine scattered black scales; a moderate blackish dot in disc above middle; a series of indistinct fuscous dots marked with black

scales from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, curved outwards on upper $\frac{2}{3}$; a subterminal series of small indistinct fuscous spots marked with black scales; a hindmarginal series of large black dots: cilia whitish. Hindwings with hindmargin rounded; ochreous-whitish, with scattered blackish scales on lower half; hindmarginal dots and cilia as in forewings.

Quorn, South Australia, in October; one specimen. This is not in very good condition, but is certainly a good species, most resembling the preceding, but well distinguished by the somewhat more elongate wings, smaller size, relatively shorter palpi, subterminal spots, and the large size of hindmarginal dots; from the rest its ochreous-whitish colouring readily separates it.

12. *Tax. isophanes*, n.sp.

♂♀. 22-27 mm. Head whitish-grey, forehead whitish-ochreous, face dark fuscous. Palpi 2, dark fuscous, base white. Antennæ grey-whitish. Thorax and abdomen pale grey, with scattered dark fuscous scales. Legs dark grey, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin straight above, rounded beneath; 12 connected by bar with 11; grey, suffusedly irrorated with pale greyish-ochreous, with fine scattered black scales; an indistinct dark fuscous dot on costa at $\frac{1}{3}$, a second on inner margin about $\frac{2}{5}$, and two more distinct in a straight line between these; a moderate dark fuscous dot in disc above middle; a fine slightly curved and sinuate cloudy fuscous line from about $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, marked with obscure dark fuscous dots; a subterminal series of small obscure cloudy dark fuscous spots; a hindmarginal series of black dots: cilia pale greyish-ochreous, basal half mixed with grey. Hindwings with hindmargin rounded; light fuscous irrorated with darker, becoming darker posteriorly; hindmarginal dots and cilia as in forewings.

Murrurundi (1500 feet), New South Wales; Melbourne, Victoria; Mount Lofty, South Australia; in October, four specimens. An obscure-looking species, characterised by the dull colouring, absence of ochreous lines, slightly curved second line not angulated near costa, and presence of subterminal spots.

13. *Tax. philodora*, n.sp.

♂. 20 mm. Head whitish-ochreous, forehead more whitish, face dark ferruginous-fuscous. Palpi 2, dark ferruginous-fuscous, towards base white. Antennæ, thorax, abdomen, and legs whitish-ochreous. Forewings triangular, hindmargin oblique, straight above, rounded beneath; 12 connected by bar with 11; whitish-ochreous, irrorated with yellowish-ochreous in disc; a straight thick blackish line from beyond $\frac{1}{3}$ of costa to beyond $\frac{1}{3}$ of inner margin, interrupted immediately beneath costa, preceded except on costa by a brownish suffusion; a thick blackish inwards-curved and twice sinuate line from hindmargin below apex to inner margin at $\frac{3}{4}$, followed by a brownish suffusion, and interrupted near upper extremity by a straight cloudy whitish subterminal shade running from near costa to anal angle; space between this and hindmargin marked with fine dark fuscous strigulæ and scattered black scales: cilia whitish-ochreous mixed with dark fuscous (imperfect). Hindwings with hindmargin rounded; whitish-ochreous, fuscous-tinged, with scattered dark fuscous scales; three parallel cloudy dark fuscous lines starting from lower third of inner margin but not reaching far across wing; cilia whitish mixed with fuscous (imperfect).

Carnarvon, West Australia; one specimen in October. Exceptionally distinct.

2. Darantasia, Walk.

Face with projecting cone of scales. Tongue developed. Antennæ in ♂ shortly bipectinated almost to apex, pectinations terminating in pencils of cilia. Palpi rather long, porrected, rough-scaled. Forewings with vein 10 anastomosing with 9, 11 anastomosing strongly with 10 before 9, 12 connected by bar with 11. Hind wings with veins 6 and 7 stalked.

Nearly related to *Nearcha*, and doubtless a development of it; contains only the one species, which in superficial appearance shows some reversionary tendency towards *Dichromodes*.

14. *Dar. flavicapitata*, Gn.

(*Tephrina flavicapitata*, Gn. X. 98; *T. capitata*, Walk. 965; *Darantasia mundiferaria*, ib. 1743.)

♂♀. 29-33 mm. Head pale yellowish, face dark fuscous. Palpi $2\frac{1}{2}$-3, dark fuscous, beneath yellowish-white towards base. Antennæ ochreous-whitish, obscurely spotted with fuscous. Thorax fuscous. Abdomen light fuscous, basal segment with a deep ochreous apical band. Legs fuscous. Forewings triangular, hindmargin bowed, slightly waved; fuscous, sprinkled with black, especially in ♀, in ♂ irrorated with light greyish-ochreous; lines ochreous-whitish, well-marked, thicker in ♀; first almost straight from beyond $\frac{1}{4}$ of costa to $\frac{2}{5}$ of inner margin, anteriorly margined with ferruginous in disc; a small transverse-oval blackish ring in disc above middle, obscurely ferruginous-tinged; second line from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, upper $\frac{2}{3}$ very slightly curved outwards, posteriorly margined with ferruginous except towards costa; an obscurely indicated irregular sinuate and dentate pale subterminal line, beyond which the hindmarginal area is suffusedly irrorated with ochreous-whitish; a hindmarginal series of black dots: cilia fuscous or whitish-fuscous, irrorated and sometimes obscurely barred with ochreous-whitish. Hindwings with hindmargin rounded; pale fuscous, more or less sprinkled with dark fuscous; an obscure sinuate pale line at $\frac{2}{3}$, in ♂ almost obsolete; hindmarginal dots and cilia as in forewings.

Blackheath (3500 feet), New South Wales; Mount Lofty, South Australia; in October, common.

3. Nearcha, n.g.

Face with projecting cone of scales. Tongue developed. Antennæ in ♂ bipectinated almost or quite to apex. Palpi moderate or long, porrected, with long rough projecting scales. Thorax hairy beneath. Forewings with vein 10 anastomosing or connected at a point with 9, 11 anastomosing strongly with 10 before 9. Hindwings with veins 6 and 7 stalked.

Presumably a development from *Dichromodes*, but the gap between them is rather considerable. There is a good deal of affinity to *Epidesmia*, but apparently collateral. The species are dull-coloured and superficially extremely similar, though fortunately they possess admirable points of distinction in the tufts which the ♂'s often possess on the lower surface of the hindwings or sides of abdomen. The colour and length of the palpi also afford good characters; those species which have long palpi have also the frontal tuft elongate. The genus is endemic; but the New Zealand genus *Theoxena* approaches it rather nearly.

1. Abdomen in ♂ with large lateral tufts on 5th segment	18. *paraptila*.
Abdomen in ♂ without lateral tufts	2.
2. Palpi long ($3\frac{1}{2}$), pale ochreous	3.
Palpi moderate (2-$2\frac{1}{2}$), blackish	5.
3. Hindwings in ♂ beneath with blackish subcostal tuft at $\frac{1}{4}$	19. *subcelata*.
Hindwings in ♂ beneath without blackish subcostal tuft at $\frac{1}{4}$	4.
4. Hindwings in ♂ beneath with subcostal spot of short pale hairs	20. *atyla*.
Hindwings in ♂ beneath without subcostal spot of short pale hairs	21. *curtaria*
5. Hindwings in ♂ beneath with subcostal tufts	6.
Hindwings in ♂ beneath without subcostal tufts	15. *staurotis*.
6. Hindwings in ♂ beneath with two blackish subcostal tufts	16. *buffalaria*.
Hindwings in ♂ beneath with one blackish subcostal tuft	17. *aridaria*.

15. *Nearch. staurotis*, n.sp.

♂♀. 25-27 mm. Head grey-whitish, between antennæ yellowish-white, face dark fuscous. Palpi 2-$2\frac{1}{2}$, blackish-fuscous, basal

half obliquely white. Antennæ grey-whitish, pectinations dark grey. Thorax whitish-grey. Abdomen grey-whitish, with a few scattered dark grey scales, basal segment in ♂ whitish-ochreous towards apex. Legs pale greyish-ochreous, femora sprinkled with dark fuscous, posterior legs ochreous-whitish. Forewings triangular, hindmargin bowed; pale ochreous-grey, finely sprinkled with blackish; four blackish dots or small spots forming a slightly curved series from $\frac{1}{5}$ of costa to $\frac{2}{5}$ of inner margin; a small transverse-oval blackish-grey pale-centred spot in disc above middle; an indistinct whitish or pale ferruginous gently curved line from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, slightly sinuate inwards towards inner margin, margined anteriorly by a series of black dots or small triangular spots, and followed on lower $\frac{2}{3}$ by a more or less developed blackish-grey shade, broadening downwards; a faint cloudy paler subterminal line; a hindmarginal series of black dots: cilia light ochreous-grey. Hindwings with hindmargin rounded; in ♂ without tufts beneath; colour, subterminal line, hindmarginal dots and cilia as in forewings; a faint curved whitish line beyond middle, anteriorly margined with cloudy suffused blackish dots.

Geraldton, West Australia; in November, common.

16. *Nearch. buffalaria*, Gn.

(*Panagra buffalaria*, Gn. X. 128; *P. ursaria*, ib. 129; *P. transactaria*, Walk. 999; *P. resignata*, ib. 1003; ? *P. reserata*, ib. 1010.)

♂♀. 26-32 mm. Head light ochreous-grey, face blackish. Palpi $2\frac{1}{2}$, blackish, towards base white. Antennæ grey-whitish. Thorax and abdomen light ochreous-grey. Legs light greyish-ochreous, femora and posterior tibiæ sprinkled with blackish, middle and posterior femora roughly haired beneath, posterior tibiæ in ♂ dilated, enclosing pencil of hairs in groove. Forewings triangular, hindmargin bowed, waved, in ♀ slightly sinuate beneath apex; ochreous-grey, with fine scattered dark fuscous scales; costal edge more or less distinctly pale ferruginous; a blackish dot in disc at $\frac{1}{3}$, one on inner margin at $\frac{2}{5}$, and one on fold between these, sometimes preceded by traces of a whitish anteriorly ferruginous-margined

line; a small transverse-oval fuscous pale-centred spot above middle of disc; a faint paler or ochreous-whitish line from towards costa at $\frac{3}{4}$ to $\frac{3}{4}$ of inner margin, sinuate outwards in middle of disc, margined anteriorly by a series of black triangular dots and posteriorly by a pale ferruginous shade; a faint fuscous shade beyond this; a hindmarginal series of blackish dots: cilia light grey or greyish-ochreous, sometimes with a fuscous interrupted line. Hindwings with hindmargin rounded; in ♂ on undersurface with a large subcostal tuft of greyish-ochreous hairs mixed with dark fuscous at $\frac{1}{4}$, a smaller similar subcostal tuft in middle, and a ridge of pale greyish-ochreous hairs in disc beneath these; grey, sprinkled with dark fuscous; sometimes a faint pale curved median line, preceded by cloudy suffused blackish dots; hindmarginal dots and cilia as in forewings.

Sydney, New South Wales; Tasmania; Mount Lofty, South Australia; Perth, West Australia; from August to October and in March, common.

17. *Nearch. aridaria*, Walk.

(*Tephrina aridaria*, Walk. Suppl. 1662.)

♂♀. 25-28 mm. Head whitish-grey, becoming ochreous-whitish on forehead, face blackish. Palpi 2, blackish, towards base white. Antennæ grey-whitish. Thorax and abdomen pale grey or whitish-grey, with a few blackish scales. Legs grey, femora and posterior tibiæ grey-whitish sprinkled with dark fuscous, middle and posterior femora partly rough-haired beneath. Forewings triangular, hindmargin bowed, waved; light ochreous-grey, with scattered dark grey scales; costal edge more or less distinctly pale ochreous; a slightly curved blackish line from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, in ♀ reduced to four dots; a transverse-oval sometimes obscurely pale-centred blackish spot in disc above middle, in ♀ much paler or obsolete; a blackish irregular line from before $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, upper $\frac{2}{3}$ moderately curved outwards and sinuate above middle, in ♀ reduced to a series of black dots connected by an obscure grey line; in ♂ this is closely followed except towards

costa by a cloudy blackish-grey shade, posteriorly somewhat mixed with ochreous, in ♀ represented by an obscure ochreous line; a series of very indistinct cloudy grey subterminal spots; a hindmarginal series of black dots: cilia pale grey, with a faint interrupted darker line. Hindwings with hindmargin rounded; in ♂ on undersurface with a thin subcostal ridge of pale greyish-ochreous hairs terminating beyond middle in a small tuft mixed with dark fuscous; colour, hindmarginal dots, and cilia as in forewings; a blackish-grey discal dot, in ♀ sometimes obsolete; a cloudy blackish-grey median line, slightly angulated in middle, sinuate beneath, in ♀ obscure or obsolete.

Duaringa, Queensland; Bathurst (2500 feet), New South Wales; in November and March, common.

18. *Nearch. paraptila*, n.sp.

♂. 28 mm. Head fuscous-whitish, face dark ferruginous-fuscous. Palpi 2, fuscous. Antennæ fuscous-whitish. Thorax whitish-fuscous. Abdomen whitish-fuscous, with a few dark fuscous scales, 4th segment with a small lateral pencil of hairs, and a small horny ventral hook, 5th segment with a large tuft of blackish hairs on each side, mixed with pale greyish-ochreous. Legs fuscous, posterior pair fuscous-whitish. Forewings triangular, hindmargin bowed; whitish-fuscous, sprinkled with dark fuscous; faint traces of a pale ferruginous line from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, preceded by three blackish dots on veins; a transverse linear dark fuscous mark in disc above middle; traces of a pale ferruginous irregular line, posteriorly marked with a series of blackish dots, from $\frac{2}{3}$ of costa to $\frac{2}{3}$ of inner margin, upper $\frac{2}{3}$ rather strongly curved outwards, sinuate inwards above middle and towards inner margin; a subterminal series of dark fuscous dots; a hindmarginal series of blackish dots: cilia whitish-fuscous (imperfect). Hindwings with hindmargin rounded; without tufts beneath; colour, subterminal and hindmarginal dots, and cilia as in forewings; a faint ferruginous median line, marked with blackish dots, sinuate outwards in middle.

Toowoomba, Queensland; in December, one specimen.

19. *Nearch. subcelata*, Walk.

(*Panagra subcelata*, Walk. 997.)

♂♀. 27-28 mm. Head and thorax pale brownish-ochreous. Palpi 3½, pale greyish-ochreous, in ♀ fuscous-tinged. Antennæ and abdomen ochreous-whitish. Legs light fuscous, femora and posterior tibiæ ochreous-whitish sprinkled with dark fuscous. Forewings triangular, hindmargin sinuate on upper half, rounded beneath; whitish-ochreous, slightly brownish-tinged, more decidedly in ♀, finely sprinkled with dark fuscous; a slightly curved series of four black dots from beneath costa at ¼ to ⅓ of inner margin; a very small dark fuscous pale-centred spot in disc above middle, sometimes reduced to a dot without pale centre; a faintly sinuate series of black dots from beneath ¾ of costa to ⅔ of inner margin, followed in ♀ by a paler yellowish-tinged line; a small cloudy blackish spot immediately beyond this in middle, in ♀ obsolete; a hindmarginal series of black dots: cilia pale whitish-ochreous, in ♀ brownish-tinged, with a somewhat darker interrupted basal line. Hindwings with hindmargin rounded; in ♂ on undersurface with a large subcostal tuft of pale greyish-ochreous hairs mixed with blackish at ¼, beyond which is a considerable space clothed with short appressed pale greyish-ochreous hairs; pale whitish-ochreous-grey, in ♀ somewhat brownish-tinged; sometimes an obscure darker discal dot; hindmarginal dots and cilia as in forewings.

Newcastle, Sydney, and Bathurst (2500 feet), New South Wales; Warragul, Victoria; in April, not uncommon.

20. *Nearch. atyla*, n.sp.

♂♀. 28-29 mm. Only differs from *N. subcelata* as follows: head white on crown; hindwings in ♂ on undersurface with a small spot of short appressed pale greyish-ochreous hairs beneath costa before middle, without tuft, and with a well-marked dark fuscous discal dot.

Perth and Albany, West Australia, in November; three specimens.

21. *Nearch. curtaria*, Gn.

(*Panagra curtaria*, Gn. X. 129; *P. corrogata*, Walk. 997.)

♂♀. 28-31 mm. Head, thorax, and abdomen pale whitish-ochreous. Palpi 3½, whitish-ochreous, externally mixed with fuscous, base white. Antennæ whitish, pectinations grey. Legs pale ochreous, posterior pair whitish, femora sprinkled with dark fuscous. Forewings triangular, hindmargin sinuate on upper half, slightly rounded beneath; whitish-ochreous, with a few scattered dark fuscous scales, towards costa faintly strigulated with pale brownish; a black dot in disc at ⅓, one on inner margin at ⅓, and a third between these; a small roundish dark fuscous pale-centred spot in disc above middle, sometimes reduced to a dot without pale centre; a series of cloudy blackish dots, partially connected by an incomplete obscure dark fuscous line, from ¾ of costa to ⅔ of inner margin, rather strongly sinuate outwards on middle third, and inwards on lower third, nearly followed on lower ⅔ by an obscure brownish-ochreous line; a hindmarginal series of black dots: cilia pale whitish-ochreous. Hindwings with hindmargin almost straight, slightly waved, apex prominent; in ♂ without tufts beneath; ochreous-whitish, sprinkled with pale grey; a hindmarginal series of black dots; cilia ochreous-whitish.

Sydney, New South Wales; Hobart, Tasmania; in March, rather common locally. The different form of the hindwings makes this species easy of recognition.

4. SATRAPARCHIS, n.g.

Tongue developed. Antennæ in ♂ unipectinated, towards apex simple. Palpi moderately long, porrected, rough-scaled. Forewings with vein 10 out of 9, 11 anastomosing shortly with 9. Hindwings with veins 6 and 7 short-stalked.

Certainly a development of *Epidesmia*, containing only the following species.

22. *Satr. bijugata*, Walk.

(*Panagra bijugata*, Walk. 1663; *Melanippe teliferata*, ib. 1712).

♂♀. 30-32 mm. Head dark fuscous, with a whitish transverse line below forehead. Palpi dark fuscous, base whitish. Antennæ black with a white line on back. Thorax (partly defaced) blackish, patagia slenderly margined with whitish. Abdomen blackish, segmental margins whitish. Legs black, sprinkled with white. Forewings triangular, hindmargin rounded; blackish, sprinkled with white towards base; a yellowish-white fascia from middle of costa to anal angle, margins straight, broadest on costa and enclosing a blackish median bar from costa reaching to near middle; a pale bluish line close beyond fascia, becoming yellowish-white on anal angle, where it coalesces with a yellowish-white somewhat irregular submarginal line; branches of subcostal vein beyond fascia finely whitish-ochreous, terminating in small spots on hindmargin; between these are more or less distinct fine blue-whitish lines: cilia blackish, with a fine white basal line, tips grey-whitish, on anal angle wholly yellowish-white. Hindwings with hindmargin rounded; yellowish-white; a moderate transverse blackish discal spot; a broad blackish hindmarginal band, anterior edge sinuate, attenuated to anal angle, containing a triangular yellowish-white spot in its lower extremity; cilia yellowish-white.

Rockhampton and Duaringa, Queensland; Grafton, New South Wales; in August, four specimens (Coll. Macleay).

5. Epidesmia, Westw.

Face smooth or with slightly projecting scales. Tongue developed. Antennæ in ♂ unipectinated, towards apex simple. Palpi long or extremely long, porrected, rough-scaled, attenuated. Forewings with vein 10 touching or anastomosing with 9, 11 anastomosing with 10. Hindwings with veins 6 and 7 approximated at base.

Presumably a development from *Dichromodes*, or perhaps collaterally with it from an earlier form; confined to Australia. The species, though sometimes comparatively large, are slenderly built; but I conjecture that the prominence of the apex of hindwing, often a well-marked feature, is due to an exaggeration of the prolonged form of wing characteristic of the heavily built genera, and points back to an origin from these.

1. Hindwings blackish, with orange discal blotch	23. *tricolor.*
Hindwings not blackish, with orange discal blotch	2.
2. Hindwings orange	26. *chilonaria.*
Hindwings not orange	3.
3. Hindwings white	25. *replicataria.*
Hindwings not white	4.
4. Forewings with three white lines from costa converging to anal angle	24. *transcissata.*
Forewings without three white lines from costa converging to anal angle	5.
5. Face and palpi blackish-fuscous	6.
Face and palpi not blackish-fuscous	7.
6. Forewings dark fuscous	30. *oxyderces.*
Forewings brownish-ochreous	28. *tryxaria.*
7. Cilia with dark fuscous basal line	31. *reservata.*
Cilia without dark fuscous basal line	8.
8. Palpi 6, ochreous-fuscous	27. *hypenaria.*
Palpi 4, whitish-yellowish, fuscous-tinged	29. *perfabricata.*

23. *Ep. tricolor*, Westw.

(*Epidesmia tricolor*, Westw., Duncan's Exot. Moths, 220, pl. XXVIII. 1.)

♂♀. 64 mm. Head, palpi, antennæ, thorax, and legs dark fuscous; palpi 4, at base beneath yellowish-white. Abdomen whitish-sulphur, towards base fuscous. Forewings triangular, hindmargin sinuate beneath apex, rounded; dark fuscous, ochreous-tinged, towards hindmargin somewhat lighter; a moderate whitish-sulphur fascia from middle of costa to inner margin before anal angle, narrowed beneath, anterior edge almost straight, posterior edge projecting triangularly below middle: cilia grey, with a dark grey line, at apex white. Hindwings with apex rather prominent, hindmargin almost straight; blackish; a large yellowish-orange irregular roundish spot in middle of disc; two snow-white marginal dots at and above apex; cilia blackish, above apex snow-white.

Sydney, New South Wales; ten specimens (Coll. Macleay). I am informed by Mr. Masters that this large and conspicuous species was common in Sir William Macleay's garden twenty years ago; it then appeared to become extinct, without apparent reason, and was not seen again there or elsewhere until quite lately, when it has once more reappeared in the same locality.

24. *Ep. transcissata*, Walk.

(*Phrataria transcissata*, Walk. 1742.)

30 mm. Forewings dark fuscous; all veins fuscous-whitish; a straight narrow white fascia from costa before middle, a white line from costa at $\frac{2}{3}$, and a white line from apex before hindmargin, all converging to anal angle; a whitish shade nearly preceding fascia on lower half; a darker transverse spot, margined with whitish, in disc beyond fascia. Hindwings pale grey; a discal grey ring, containing a very small similar ring; an indistinct whitish line at $\frac{2}{3}$, and another before hindmargin.

Diagnosis taken from type in British Museum.

25. *Ep. replicataria*, Walk.

(*Phrataria replicataria*, Walk. Suppl. 1700.)

♂. 29-30 mm. Head rather dark fuscous, with a yellowish-white transverse line on forehead. Palpi $2\frac{1}{2}$, fuscous, towards base white. Antennæ fuscous, with a white line on stalk, pectinations 4. Thorax rather dark fuscous, becoming white posteriorly. Abdomen white. Legs white, densely irrorated with blackish, anterior pair suffused with blackish except apex of joints. Forewings triangular, hindmargin straight above, rounded beneath; rather dark fuscous; a whitish line along vein 1 from base, meeting the anterior of two closely parallel whitish lines from $\frac{1}{5}$ of costa to anal angle; two closely parallel white lines from $\frac{2}{5}$ of costa to middle of disc, curved round and returning to costa at $\frac{3}{5}$; in lower portion of included space is a thick transverse-linear cloudy blackish mark; a nearly straight white streak from $\frac{3}{4}$ of costa to anal angle, rather bent outwards

on costa, anterior margin rather suffused, touching preceding curved line and tending to be produced along branches of median vein, posteriorly sharply defined and closely followed by a fine parallel white line dilated towards lower extremity; a slightly inwards-curved denticulate white line from costa immediately before apex to hindmargin above anal angle; a blackish interrupted hindmarginal line, margined anteriorly by a whitish waved line: cilia fuscous, base and apex white, towards anal angle wholly white. Hindwings with hindmargin rounded; white; a few scattered black scales along inner margin; an interrupted blackish hindmarginal line or row of dots; cilia white; undersurface with a small dark fuscous discal spot, a sinuate line at $\frac{3}{4}$, and an incomplete subterminal fascia, which show through obscurely on upper surface.

Blackheath (3500 feet) and Mount Kosciusko (4700 feet), New South Wales; in January and February, amongst *Eucalyptus*-forest, four specimens.

26. *Ep. chilonaria*, HS.

(*Hemagalma chilonaria*, HS. Exot. 350; *Panagra aurinaria*, Gn. X. 127, pl. VII. 7).

♂♀. 38-42 mm. Head ochreous-brown, forehead ochreous-white, face dark ferruginous-fuscous. Palpi 4, deep ferruginous-fuscous, towards base white beneath. Antennæ ochreous-whitish, pectinations 4, fuscous. Thorax ochreous-fuscous, darker anteriorly. Abdomen whitish-fuscous. Legs ferruginous-fuscous, irrorated with ochreous-whitish, anterior pair banded with dark fuscous. Forewings triangular, hindmargin gently rounded; ochreous-fuscous, slightly reddish-tinged, somewhat sprinkled with dark grey; costal edge slenderly ochreous-whitish, bordered beneath by a darker suffusion anteriorly; a cloudy dark fuscous dot in disc above middle, another above inner margin before middle, and a third in disc midway between these; a nearly straight slender whitish-ochreous or whitish-fuscous line from near costa at $\frac{3}{4}$ to about $\frac{3}{4}$ of inner margin, margined posteriorly by a cloudy dark

fuscous line disappearing towards upper extremity; a faint subterminal series of small obscure darker spots; a hindmarginal series of black dots, sometimes obsolete: cilia light ochreous-reddish, tips more whitish-ochreous. Hindwings with apex more or less prominent, hindmargin slightly rounded; deep orange; an obscure dark fuscous discal dot; a moderately broad hindmarginal band of thin dark fuscous irroration, towards anal angle becoming wholly fuscous, slightly reddish-tinged, and obscurely continued along inner margin towards base, gradually becoming obsolete; a hindmarginal series of blackish dots; cilia light ochreous-reddish.

Newcastle and Sydney, New South Wales; Fernshaw and Dandenong Ranges, Victoria; in November and December, flying readily in the sunshine, six specimens.

27. *Ep. hypenaria*, Gn.

(*Panagra hypenaria*, Gn. X. 128; ? *Hemagalma inspersa*, Feld. pl. CXXIX. 19.)

♂♀. 32-41 mm. Head brownish-ochreous, crown sometimes ochreous-whitish. Palpi 6, ochreous-fuscous, darker beneath, towards base yellowish-white beneath. Antennæ whitish-fuscous, pectinations 16, dark fuscous. Thorax ochreous-brown. Abdomen whitish-fuscous. Legs rather dark fuscous, femora irrorated with pale greyish-ochreous. Forewings triangular, hindmargin sinuate beneath apex, thence bowed; rather light ochreous-brown or fuscous, more or less irrorated with dark fuscous, suffused with darker towards costa anteriorly; costal edge bright ferruginous towards base, becoming pale whitish-ochreous posteriorly; a cloudy dark fuscous dot in disc above middle, another above inner margin at $\frac{2}{5}$, and a third in disc midway between these; a nearly straight narrow pale ochreous or whitish-ochreous streak from towards costa at $\frac{3}{4}$ to $\frac{2}{3}$ of inner margin, posteriorly margined by a cloudy darker fuscous posteriorly suffused shade, dividing line darker and sometimes marked with obscure blackish dots; faint traces of a pale waved subterminal line; a hindmarginal series of black dots: cilia pale brownish-ochreous, base sometimes fuscous. Hindwings

with apex prominent, hindmargin almost straight, rounded at extremities; pale fuscous or whitish-fuscous, sometimes ochreous-tinged; a dark fuscous discal dot; hindmargin suffused with darker fuscous, forming a very indistinct band containing a faint obscure paler subterminal line; hindmarginal dots and cilia as in forewings.

Glen Innes (3500 feet), Newcastle, Sydney, Blackheath (3500 feet), and Mount Kosciusko (6500 feet), New South Wales; Melbourne and Mount Macedon, Victoria; Deloraine and Georges Bay, Tasmania, from September to February; common. Distinct from all others structurally by the great length of the antennal pectinations and palpi.

28. *Ep. tryxaria*, Gn.

(*Panagra tryxaria*, Gn. X. 128.)

♂♀. 28-34 mm. Head ochreous-brown, forehead ochreous-whitish, face blackish, ferruginous-tinged. Palpi 3-3½, blackish-fuscous, ferruginous-tinged, towards base white beneath. Antennæ whitish, annulated with fuscous or blackish, pectinations 4, dark fuscous. Thorax ochreous-brown, becoming whitish-ochreous posteriorly. Abdomen ochreous-whitish sprinkled with fuscous. Legs rather dark fuscous ringed with whitish, femora and posterior tibiæ whitish irrorated with dark fuscous. Forewings triangular, hindmargin bowed; light brownish-ochreous irrorated with dark fuscous, suffused with darker towards base of costa; costal edge whitish, towards base ochreous-tinged; a cloudy dark fuscous dot in disc above middle, another above inner margin before middle, and a third in disc between these; a straight ochreous, ochreous-fuscous, or dark fuscous cloudy line from $\frac{4}{5}$ of costa to $\frac{3}{4}$ of inner margin, slenderer and indistinct above, sometimes marked with a series of dark fuscous dots, margined anteriorly by an ochreous-whitish or whitish-ochreous line, and posteriorly by an obscure fuscous suffusion; a subterminal series of indistinct dark fuscous dots; a hindmarginal series of blackish dots: cilia fuscous-whitish, with an indistinct fuscous line. Hindwings with hindmargin slightly rounded; colour, subterminal and hindmarginal

dots, and cilia as in forewings; an indistinct dark fuscous discal dot, a straight cloudy whitish-ochreous line beyond middle, posteriorly margined on lower half by a dark fuscous streak; traces of a pale waved subterminal line.

Sydney, New South Wales, in November and March; common.

29. *Ep. perfabricata*, Walk.

(*Panagra perfabricata*, Walk. 996.)

♂♀. 28-37 mm. Head, palpi, and thorax whitish-yellowish tinged with fuscous; palpi 4, base whitish beneath. Antennæ whitish, ringed with pale fuscous, pectinations 4, fuscous. Abdomen whitish. Legs fuscous, femora and posterior tibiæ whitish irrorated with dark fuscous. Forewings triangular, hindmargin bowed; very pale whitish-fuscous, densely irrorated with whitish-yellowish, towards costa tinged with brownish-ochreous; costal edge whitish except towards base; a dark fuscous dot in disc above middle, another above inner margin at $\frac{2}{5}$, and a third in disc between these; a straight dark fuscous line from beneath costa at $\frac{4}{5}$ to $\frac{3}{4}$ of inner margin, attenuated and indistinct above, marked with obscure darker dots, anteriorly margined by an ochreous-whitish line; a hindmarginal series of blackish dots: cilia white. Hindwings with hindmargin hardly rounded, apex somewhat prominently rounded; fuscous-whitish, slightly yellowish-tinged; a dark fuscous discal dot; a very slightly curved cloudy whitish line beyond middle, posteriorly margined on lower half by a fuscous streak; a hindmarginal series of blackish dots; cilia white.

Duaringa, Queensland; Bathurst (2500 feet) and Mount Kosciusko (3000 feet), New South Wales; in January, locally common.

30. *Ep. oxyderces*, n.sp.

♂. 31 mm. Head dark ferruginous-brown, forehead ochreous-whitish, face blackish-fuscous. Palpi $3\frac{1}{2}$, dark fuscous, towards base white beneath. Antennæ fuscous, stalk ochreous-whitish towards base, pectinations 4. Thorax dark fuscous, anteriorly ferruginous-tinged. Abdomen fuscous-whitish irrorated with dark

fuscous. Legs fuscous, apex of joints whitish, femora and posterior tibiæ dark fuscous irrorated with whitish. Forewings triangular, hindmargin rounded; dark fuscous, anteriorly ferruginous-tinged, posteriorly slightly purplish; an ochreous-whitish streak along costa from base to $\frac{4}{5}$, suffusedly edged beneath with ferruginous, extremities attenuated; a sharply defined straight narrow white streak from $\frac{3}{4}$ of inner margin towards costa at $\frac{4}{5}$, reaching $\frac{3}{4}$ across wing, apex acute; a subterminal row of indistinct darker dots; an interrupted blackish hindmarginal line: cilia light reddish, basal half fuscous mixed with ochreous-whitish and obscurely spotted with dark fuscous. Hindwings with hindmargin slightly rounded, apex somewhat prominently rounded; rather dark fuscous, towards hindmargin rather purplish; a darker discal dot; a well-marked ochreous-whitish straight transverse streak beyond middle, interrupted beneath costa; a subterminal series of indistinct dark fuscous dots, preceded by a fine obscure paler waved line; hindmarginal line and cilia as in forewings.

Sydney, New South Wales; in November, one specimen taken in a jungly swamp, where the difficulties of collecting prevented my remaining long; a fine distinct species.

31. *Ep. reservata*, Walk.

(*Panagra reservata*, Walk. 996.)

♂. 25-26 mm. Head, palpi, and thorax light ochreous-brown; palpi 3½. Antennæ whitish, pectinations 10, fuscous. Abdomen fuscous-whitish. Legs fuscous, femora and posterior tibiæ whitish irrorated with dark fuscous. Forewings triangular, hindmargin rounded; whitish-fuscous, sprinkled with dark fuscous, suffused with brownish-ochreous towards base of costa; costal edge ochreous-whitish, towards base more ochreous; a dark fuscous dot in disc at $\frac{1}{3}$, another above inner margin at $\frac{1}{3}$, and a third in disc above middle; a faintly sinuate series of dark fuscous dots from beneath costa at $\frac{4}{5}$ to $\frac{3}{4}$ of inner margin, anteriorly margined by an obscure whitish line becoming obsolete towards costa; a

hindmarginal series of blackish dots: cilia whitish, with a dark fuscous basal line becoming obsolete towards anal angle. Hindwings with hindmargin slightly rounded; colour, subterminal dots, and cilia as in forewings; an obscure darker fuscous discal dot; a faintly sinuate cloudy whitish line beyond middle, posteriorly margined with suffused dark fuscous dots.

Duaringa and Rockhampton, Queensland, in May; three specimens received from Mr. G. Barnard. The antennal pectinations are much longer in this species than in any other except *E. hypenaria.*

6. Dichromodes, Gn.

Face with short projection of scales. Antennæ in ♂ unipectinated, towards apex sometimes simple. Palpi moderate, long, or very long, porrected, densely rough-scaled. Forewings with vein 10 anastomosing with 9, or sometimes separate. Hindwings with veins 6 and 7 approximated at base.

Already a genus of considerable extent, and likely to be much increased. It is confined to Australia, with the exception of two small species found in the mountains of New Zealand; these I suppose to have originated from a stray immigrant entering by way of Tasmania. The genus appears to be a development from forms resembling *Oenone* and *Brephos.* The species are nearly all dull-coloured and sometimes very variable, yet with care they are not difficult to distinguish. The uniformity of structure is remarkable; the only notable variation occurs in the anastomosis or separation of veins 9 and 10 of the forewings, of which both forms are sometimes found in the same species.

1. Hindwings clear orange in disc .... 32. *ainaria.*
   Hindwings not clear orange in disc......... 2.
2. Forewings with tufts of raised scales...... 48. *steropias.*
   Forewings without tufts of raised scales... 3.
3. Palpi white or whitish towards base beneath 4.
   Palpi at most irrorated with white beneath 20.

4 Forewings with irregular reddish-ochreous streaks on veins .... 5.
Forewings without irregular reddish-ochreous streaks on veins .... 8.
5. Forewings with first line acutely angulated in middle............................ 46. *poecilotis.*
Forewings with first line not acutely angulated in middle....................... 6.
6. Forewings with a conspicuously pale hindmarginal band............................ 38. *partitaria.*
Forewings without a conspicuously pale hindmarginal band .... 7.
7. Forewings with lines strongly marked, white.............. .... 37. *compsotis.*
Forewings with lines only partially whitish 47. *ioneura.*
8. Head whitish-ochreous on crown........... 35. *odontias.*
Head not whitish-ochreous on crown....... 9.
9. Forewings with second line very acutely angulated in middle...................... 34. *anelictis.*
Forewings with second line not very acutely angulated in middle...................... 10.
10. Head and thorax wholly dark fuscous...... 11.
Head and thorax irrorated with whitish... 14.
11. Forewings with whitish-ochreous suffusion towards costa posteriorly................. 39. *paratacta.*
Forewings without whitish-ochreous suffusion towards costa posteriorly........... 12.
12. Hindwings ochreous-tinged, with distinct darker hindmarginal band................ 33. *diasemaria.*
Hindwings not ochreous-tinged, without such band................ .... 13.
13. Forewings with cilia mixed with purplish-red .... 36. *disputata.*

Forewings with cilia not mixed with purplish-red .... 42. *liospoda.*
14. Forewings with whitish subcostal streak... 61. *confluaria.*
Forewings without whitish subcostal streak 15.
15. Forewings with first line sharply angulated beneath costa................................ 57. *ischnota.*
Forewings with first line not sharply angulated beneath costa.................... 16.
16. Forewings with second line distinctly angulated in middle........................ 17.
Forewings with second line not distinctly angulated in middle........... .... 19.
17. Forewings with second line angulated inwards on submedian fold .... 43. *explanata.*
Forewings with second line curved inwards on submedian fold.......................... 18.
18. Forewings with discal spot pale-centered... 49. *orectis.*
Forewings with discal spot wholly blackish 44. *sigmata.*
19. Forewings with lines whitish................ 45. *orthotis.*
Forewings with lines not whitish............ 40. *obtusata.*
20. Forewings with large triangular blackish discal spot................................. 62. *personalis.*
Forewings without large triangular blackish discal spot...... .... 21.
21. Palpi light brownish-ochreous..... .... 55. *estigmaria.*
Palpi dark fuscous............................ 22.
22. Forewings with second line obsolete......... 52. *ophiucha.*
Forewings with second line present......... 23.
23. Forewings with second line followed by an ochreous shade.............................. 59. *consignata.*
Forewings with second line not followed by an ochreous shade........................ 24.
24. Forewings with second line marked with a reddish-ochreous spot in middle.......... 54. *molybdaria.*

Forewings with second line not marked with a reddish-ochreous spot in middle ... 25.
25. Forewings with second line conspicuously white .... 60. *stilbiata.*
Forewings with second line not conspicuously white.................................. 26.
26. Forewings with second line distinctly dentate throughout..... .... 53. *indicataria.*
Forewings with second line not distinctly dentate throughout..... .... 27.
27. Forewings with first line entire.. .... 28.
Forewings with first line reduced to three or four black dots.............. .... 31.
28. Forewings with second line rather sharply angulated in middle....................... 29.
Forewings with second line not rather sharply angulated in middle.............. 30.
29. Forewings with median band narrow, darker .... 58. *triparata.*
Forewings with median band broad, not darker .... 50. *atrosignata* ♀.
30. Forewings with second line pale, entire.... 50. *atrosignata* ♂.
Forewings with second line reduced to a series of pale dots...... .... 41. *exsignata.*
31. Forewings with second line angulated in middle .... 51. *euscia.*
Forewings with second line almost straight 56. *ornata.*

32. *Dichr. ainaria*, Gn.

(*Dichromodes ainaria*, Gn. IX. 321, pl. III. 5; *D. divergentaria*, ib. 321; *Cidaria metaxanthata*, Walk. 1734.)

♂♀. 22-24 mm. Head, palpi, antennæ, thorax, and legs dark fuscous; palpi 2½, upper edge sprinkled with whitish; antennal pectinations 4. Abdomen rather dark fuscous. Forewings triangular, hindmargin rounded; dark fuscous, irregularly irrorated

with blackish and grey-whitish; lines cloudy, blackish; first from beyond $\frac{1}{3}$ of costa to before middle of inner margin, slightly curved, preceded by whitish irroration; second from before $\frac{2}{3}$ of costa to $\frac{2}{3}$ of inner margin, irregular and more or less denticulate, upper $\frac{3}{5}$ rather curved outwards, sinuate inwards above middle and more deeply below middle, posteriorly margined with whitish irroration; a small blackish spot in disc above middle touching second line; subterminal formed by whitish irroration, irregularly margined with blackish suffusion, irregular, more or less distinctly dentate; a waved blackish hindmarginal line: cilia dark fuscous irrorated with whitish, terminal half grey more or less obscurely barred with darker, tips whitish. Hindwings with hindmargin rounded; orange; a moderate evenly broad dark fuscous hindmarginal band, obscurely continued along inner margin but attenuated to base; cilia rather dark fuscous, tips whitish sometimes obscurely barred with fuscous.

Blackheath (3500 feet) and Bathurst (2500 feet), New South Wales; Melbourne, Victoria; Mount Lofty, South Australia; in November, common.

33. *Dichr. diasemaria*, Gn.

(*Dichromodes diasemaria*, Gn. IX. 321.)

♂♀. 24-27 mm. Head, palpi, antennæ, thorax, and legs dark fuscous; palpi $2\frac{1}{2}$-3, towards base beneath whitish; antennal pectinations 4. Abdomen whitish-fuscous irrorated with dark fuscous. Forewings triangular, hindmargin straight above, rounded beneath; fuscous, densely irregularly irrorated with blackish and whitish; an indistinct blackish transverse line near base, not reaching inner margin; lines narrow, irregular, blackish; first from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, almost straight, followed by an ochreous tinge; second from $\frac{3}{5}$ of costa to $\frac{2}{3}$ of inner margin, hardly curved or sinuate, dentate throughout, followed by a paler space; a blackish thrice deeply indented line between these, space between this and second line suffusedly darker; a transverse blackish mark in disc above middle, nearly touching second line; a very fine brownish-ochreous rather strongly sinuate denticulate

line from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin; a cloudy grey-whitish twice sinuate subterminal line, margined by dark fuscous suffusions; a waved blackish hindmarginal line: cilia fuscous, base sprinkled with whitish, tips whitish, obscurely barred with darker. Hindwings with hindmargin rounded; ochreous-fuscous, with a somewhat paler curved band at $\frac{3}{4}$, sometimes more or less suffused with yellowish; a cloudy darker fuscous discal dot; a cloudy dark fuscous mark on inner margin at $\frac{2}{3}$; a moderate evenly broad dark fuscous hindmarginal band; cilia fuscous, with a cloudy darker line, tips paler.

Georges Bay, Tasmania; in December and January, six specimens. These are unfortunately mostly in poor condition, and the species appears to vary considerably; this description may therefore require extension.

34. *Dichr. anelictis*, n.sp.

♂♀. 22-23 mm. Head, palpi, and thorax grey mixed with blackish and whitish; palpi 2, base more whitish. Antennæ dark grey spotted with whitish, pectinations 3. Abdomen whitish-grey irrorated with dark grey. Legs dark grey ringed with whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin rounded; light brownish, ochreous-tinged, sprinkled with blackish; three indistinct blackish dentate lines between base and first line, each preceded by some whitish scales; first and second lines fine, blackish, subdentate; first from $\frac{2}{5}$ of costa to middle of inner margin, angulated outwards beneath costa, sinuate below middle, anteriorly finely margined with whitish; second from $\frac{3}{5}$ of costa to $\frac{2}{3}$ of inner margin, forming a very acute angulation outwards in middle, sinuate inwards above this and more deeply below it, posteriorly finely margined with whitish; space between these darker, with denser black irroration, often interrupted at $\frac{1}{3}$ from inner margin by a bar of ground colour, interrupting also both lines; a blackish transverse mark in disc above middle, immediately preceding second line; a large ill-defined whitish or whitish-ochreous suffusion towards costa beyond second line, containing a cloudy dark fuscous costal spot;

a cloudy whitish subterminal line; a waved blackish hindmarginal line or series of spots, margined anteriorly with whitish: cilia grey, base irrorated with whitish, terminal half whitish obscurely barred with grey. Hindwings with hindmargin rounded; fuscous-grey, becoming dark grey towards hindmargin; a cloudy darker discal mark, sometimes obsolete; a blackish hindmarginal line: cilia grey-whitish, with a cloudy grey line.

Mount Lofty, South Australia; Geraldton, Perth, and Albany, West Australia; from October to December, common.

35. *Dichr. odontias*, n.sp.

♂♀. 24 mm. Head whitish-ochreous, face brownish-ochreous, with a few blackish scales. Palpi 2, rather dark fuscous, base whitish. Antennæ fuscous, pectinations 5. Thorax blackish, posteriorly mixed with pale greyish-ochreous. Abdomen pale fuscous. Legs rather dark fuscous, posterior pair light fuscous. Forewings triangular, hindmargin gently rounded; rather light fuscous, sprinkled with black; two cloudy blackish lines towards base, first not reaching inner margin; first and second lines cloudy, blackish, irregularly dentate, slightly curved; first from $\frac{2}{5}$ of costa to before middle of inner margin, preceded by a similar parallel line; second from $\frac{3}{5}$ of costa to $\frac{2}{3}$ of inner margin, followed by a similar parallel line; a narrow transverse-oval blackish spot in disc above middle, midway between first and second lines; subterminal indicated by blackish cloudy margins, irregular, subdentate, posterior margin very indistinct; a hindmarginal series of triangular blackish spots connected by a fine line: cilia pale fuscous. Hindwings with hindmargin rounded; fuscous-grey, darker towards hindmargin; cilia fuscous.

Beechworth, Victoria, in December; two specimens received from Mr. G. Barnard.

36. *Dichr. disputata*, Walk.

(*Panagra disputata*, Walk. 1009; *P. dentigeraria*, ib. 1665.)

♂♀. 22-24 mm. Head, palpi, antennæ, and thorax dark fuscous; palpi $2\frac{1}{4}$, base white beneath; antennal pectinations 4.

Abdomen dark grey. Legs dark fuscous, apex of joints whitish, femora and posterior tibiæ irrorated with grey-whitish. Forewings triangular, hindmargin rounded; dark grey, sprinkled with black and a few whitish scales, more or less tinged and sometimes suffusedly mixed with deep purple-reddish; two cloudy blackish lines towards base; first and second lines cloudy, blackish, irregularly dentate, slightly curved; first from $\frac{2}{5}$ of costa to before middle of inner margin, preceded by a similar parallel line; second from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, sometimes partially whitish-margined posteriorly, followed by a similar parallel line; a narrow transverse-oval blackish spot in disc above middle; subterminal indicated by cloudy darker margins, irregular, subdentate, anterior rather broad and marked with blackish on veins, posterior very indistinct; a hindmarginal series of triangular blackish spots connected by a fine line: cilia light fuscous, basal half irrorated or suffused with purplish-red, sometimes obscurely barred with darker. Hindwings with hindmargin rounded; fuscous-grey, darker towards hindmargin, hindmarginal line dark fuscous; cilia fuscous, towards tips whitish-fuscous.

Maryborough, Queensland; Sydney, New South Wales; also from Victoria; in October and March, rather common.

37. *Dichr. compsotis*, n.sp.

♂. 21 mm. Head and thorax blackish-fuscous mixed with white. Palpi $2\frac{1}{2}$, fuscous, base whitish beneath, upper edge whitish. Antennæ grey, pectinations $2\frac{1}{2}$. Abdomen dark fuscous, segmental margins ochreous-whitish. Legs dark fuscous ringed with whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin rounded; fuscous, irregularly mixed with black and white; veins partially streaked with brownish-ochreous; a cloudy blackish line near base; a roundish dark spot in disc towards base, surrounded by a whitish suffusion; first line broad, white, blackish-margined, from $\frac{1}{3}$ of costa to before middle of inner margin, gently curved, sinuate inwards above inner margin; a small transverse-oval blackish spot in disc above middle, placed on a dark bar joining first and second lines, and a

similar broader dark bar below middle; second line moderate, white, anteriorly black-margined, posteriorly ochreous-margined on lower half, from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, rather irregular, middle third forming a short bent curve outwards; subterminal slender, whitish, thrice sinuate, confluent beneath with a whitish irroration along hindmargin; a waved black hindmarginal line: cilia fuscous, mixed with darker, sharply barred with whitish. Hindwings with hindmargin rounded; pale whitish-fuscous, towards base slightly ochreous-tinged; a small fuscous discal spot; some white scales towards inner margin, and two white marks towards anal angle; an interrupted fuscous hindmarginal line; cilia whitish, basal half suffusedly barred with light fuscous.

Fremantle, West Australia; in October, one specimen.

38. *Dichr. partitaria*, Walk.

(*Eubolia partitaria*, Walk. Suppl. 1699; *Liodes Angasi*, Feld. pl. CXXXI. 13.)

♂♀. 18-21 mm. Head and thorax fuscous, irrorated with blackish and whitish, thorax in ♂ with a fine ochreous median line. Palpi $2\frac{1}{2}$, rather dark fuscous, beneath ochreous-white towards base, upper edge mixed with white. Antennæ dark grey, obscurely spotted with whitish, pectinations $2\frac{1}{2}$. Abdomen dark grey irrorated with whitish. Legs dark fuscous, apex of joints whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin rounded; fuscous, coarsely irrorated with black and more or less strongly with white; veins partially streaked with ferruginous-ochreous; an indistinct blackish line near base, not reaching inner margin; lines slender, white, obscurely blackish-margined; first from $\frac{1}{3}$ of costa to middle of inner margin, gently curved, sinuate inwards above inner margin; second from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, slightly curved, slightly bent inwards on submedian fold; a small transverse-oval blackish spot in disc above middle; generally two ill-defined blackish streaks connecting first and second lines below middle; subterminal cloudy, whitish, rather strongly sinuate inwards above and below middle; a grey-whitish hindmarginal band, its anterior edge very

close and parallel to subterminal line, confluent with it towards anal angle; a fine waved black hindmarginal line: cilia fuscous, suffusedly irrorated with whitish, tending to form obscure bars. Hindwings with hindmargin rounded; fuscous-grey, somewhat darker posteriorly; an obscure darker discal dot; a faint paler line at $\frac{2}{3}$, sinuate in middle, becoming white and dark-margined on inner margin; a white dark-margined mark at anal angle; cilia fuscous, tips and base ochreous-whitish except towards apex.

Northampton and Albany, West Australia; in November and December, common.

39. *Dichr. paratacta*, n.sp.

♂. 24 mm. Head and thorax blackish-fuscous. Palpi 2, dark fuscous, beneath ochreous-whitish. Antennæ dark grey, pectinations 3. (Abdomen broken.) Legs dark fuscous, apex of joints whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin waved, rounded; rather light fuscous; basal area brownish-ochreous mixed with ferruginous, margins mixed with dark fuscous; a broad dark fuscous median band, anteriorly limited by a gently curved deep ferruginous, posteriorly blackish-edged streak from before $\frac{1}{3}$ of costa to $\frac{1}{3}$ of inner margin, posteriorly by second line, which is very fine, blackish, running from $\frac{2}{3}$ of costa to before $\frac{3}{4}$ of inner margin, forming an obtuse-angled projection below middle, above this slightly sinuate, below it waved; first line within this band near anterior edge, fine, blackish, irregular, angulated outwards beneath costa; a small transverse blackish spot in disc above middle, upper extremity connected with second line by a ferruginous-ochreous bar, lower extremity touching a similar bar extending from transverse ferruginous streak to second line in middle, posteriorly obscurely blackish-margined; space between median band and apex suffused with whitish-ochreous towards costa, especially anteriorly; subterminal line hardly paler, dark-margined, irregularly denticulate, anterior margin on upper $\frac{2}{3}$ forming a moderately thick irregular partly fuscous and partly ochreous-brown shade, marked in middle with a short thick longitudinal

black dash; hindmarginal area sprinkled with whitish; a waved black hindmarginal line: cilia light fuscous irregularly mixed with whitish. Hindwings with hindmargin rounded; fuscous; inner margin towards anal angle obscurely streaked transversely with whitish and darker fuscous; a dark fuscous hindmarginal line; cilia as in forewings.

Sydney, New South Wales; in October, two specimens. In the British Museum collection a specimen of this species is placed as *Coremia strumosata*, Gn., but this determination is wholly erroneous.

40. *Dichr obtusata*, Walk.

(*Panagra obtusata*, Walk. 1008; *P. devitata*, ib. 1010.)

♂♀. 21-24 mm. Head and thorax fuscous sprinkled with whitish Palpi $2\frac{1}{2}$, dark fuscous, base whitish. Antennæ fuscous, pectinations $3\frac{1}{2}$. Abdomen whitish-fuscous, sprinkled with dark fuscous. Legs dark fuscous, femora and posterior tibiæ sprinkled with whitish. Forewings triangular, hindmargin bowed; fuscous, finely irrorated with whitish and thinly sprinkled with dark fuscous; a fine ferruginous line mixed with blackish near base, not reaching inner margin; a nearly straight well-marked ferruginous line from before $\frac{1}{3}$ of costa to $\frac{1}{3}$ of inner margin, becoming blackish at extremities; first and second lines fine, dark fuscous, irregularly dentate throughout, dilated on costa; first from $\frac{2}{5}$ of costa to middle of inner margin; second from $\frac{2}{3}$ of costa to before $\frac{3}{4}$ of inner margin, slightly curved; a small transverse-oblong dark fuscous spot in disc above middle, sometimes only outlined in dark fuscous; three twice sinuate cloudy darker fuscous lines between second line and hindmargin, first sometimes mixed with ferruginous; a waved blackish hindmarginal line: cilia fuscous sprinkled with whitish. Hindwings with hindmargin rounded; fuscous, posteriorly irrorated with darker, tending to form cloudy lines towards inner margin; a dark fuscous hindmarginal line; cilia fuscous sprinkled with whitish.

Bathurst (2700 feet), New South Wales; Mount Lofty, South Australia; in November, six specimens.

41. *Dichr. exsignata*, Walk.

(*Panagra exsignata*, Walk. 1010.)

♂. 22-24 mm. Head, palpi, and thorax wholly dark fuscous; palpi $2\frac{1}{4}$. Antennæ grey, pectinations $3\frac{1}{2}$. Abdomen pale fuscous irrorated with darker. Legs dark fuscous, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin bowed; fuscous, with a few blackish scales, somewhat darker on median band and along costa; an obscure slightly paler ferruginous-tinged nearly straight line from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, posteriorly more or less distinctly edged with blackish, especially towards inner margin; a small cloudy transverse dark fuscous spot in disc above middle; second line indicated by a very obscure sinuate series of pale dots preceded by blackish scales from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin; subterminal hardly paler, very obscure, irregularly subdentate; hindmargin somewhat sprinkled with whitish; a waved blackish hindmarginal line: cilia fuscous, base sprinkled with whitish, terminal half whitish-fuscous. Hindwings with hindmargin rounded; fuscous; a faint darker discal mark; a darker hindmarginal line; cilia as in forewings.

Sydney, New South Wales, from September to November; five specimens.

42. *Dichr. liospoda*, n.sp.

♂. 23 mm. Head, palpi, and thorax dark ashy-fuscous; palpi $2\frac{1}{2}$, towards base white beneath. Antennæ dark fuscous, pectinations 3. Abdomen pale grey, suffusedly irrorated with dark grey. Legs dark fuscous, apex of joints whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin bowed; dark ashy-fuscous; an obscure blackish line near base, not reaching inner margin; a nearly straight obscure blackish line from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin; lines extremely obscure, hardly perceptibly darker, starting from cloudy blackish spots on costa at $\frac{2}{5}$ and $\frac{3}{5}$, second gently curved; a narrow obscure blackish transverse mark in disc above middle; subterminal very faintly indicated, not traceable; an interrupted blackish hindmarginal

line: cilia dark ashy-fuscous, with a few whitish points, towards tips paler. Hindwings with hindmargin rounded; rather dark fuscous; cilia rather dark fuscous.

Sydney, New South Wales; in September, one specimen.

43. *Dichr. explanata*, Walk.

(*Panagra explanata*, Walk. 1009.)

♂♀. 20-24 mm. Head and thorax dark grey irrorated with whitish and black. Palpi 3, dark grey irrorated with black, towards base white beneath, upper edge sprinkled with whitish. Antennæ grey, pectinations 5. Abdomen whitish-grey, suffusedly irrorated with dark grey. Legs dark fuscous, apex of joints whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin bowed; fuscous, irrorated with black and white; lines whitish, obscurely darker-margined; first from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, straight; second from before $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, moderately angulated outwards in middle, rather deeply sinuate inwards above middle and obtusely angulated inwards on submedian fold; a narrow transverse cloudy blackish spot in disc above middle; subterminal cloudy, whitish, very ill-defined, sinuate inwards above and below middle; a waved blackish hindmarginal line: cilia fuscous irrorated with blackish and whitish, terminal half fuscous-whitish obscurely barred with fuscous. Hindwings with hindmargin rounded; fuscous, rather darker posteriorly; a very faint paler sinuate line at $\frac{2}{3}$; a dark fuscous hindmarginal line; cilia fuscous, tips whitish-fuscous.

Bathurst (2500 feet) and Sydney, New South Wales; Melbourne, Victoria; Albany, West Australia; in November, December, and March, rather common.

44. *Dichr. sigmata*, Walk.

(*Panagra sigmata*, Walk. 1005.)

♀. 21 mm. Forewings fuscous, irrorated with whitish and blackish; lines whitish, margined with blackish; first rather bent beneath costa, otherwise straight; second obtusely angulated in middle, sinuate inwards above middle and more deeply on lower

half; a moderately large narrow transverse blackish spot in disc above middle; subterminal whitish, anteriorly suffusedly margined with dark fuscous, rather irregular; a waved blackish hindmarginal line. Hindwings fuscous.

Said to be from Sydney, New South Wales. The above diagnosis is drawn from incomplete notes taken from the British Museum specimen, which is the only one I have seen; it appears to be a good species, allied to *D. explanata*.

45. *Dichr. orthotis*, n.sp.

♂♀. 21-25 mm. Head and thorax dark fuscous, sprinkled with whitish, blackish, and ferruginous scales. Palpi about 3, dark fuscous, towards base white beneath, upper edge sprinkled with whitish. Antennæ grey, pectinations 5. Abdomen whitish-grey, suffusedly irrorated with dark grey. Legs blackish, apex of joints white, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin bowed; fuscous; basal area more or less mixed with ferruginous, and coarsely irrorated with black; first line straight, whitish, from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, anteriorly margined with deep ferruginous, posteriorly with three or four black dots; median area densely irrorated with whitish, less strongly on costa and inner margin, sometimes partially irrorated with black on veins; a moderate transverse-oblong fuscous black-margined spot in disc above middle; second line almost straight, whitish, from before $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, dilated on costa, anteriorly margined with black triangular dots, posteriorly with a ferruginous line; hindmarginal area irrorated with black, sometimes with traces of an irregular twice deeply sinuate whitish subterminal line, and a whitish irroration along hindmargin; veins near hindmargin sometimes marked with light ferruginous; a waved blackish hindmarginal line: cilia fuscous, irrorated with blackish and whitish, terminal half fuscous-whitish obscurely barred with fuscous. Hindwings with hindmargin rounded; fuscous; a faint paler slightly curved

line at $\frac{2}{3}$; some white scales towards inner margin; a darker hindmarginal line; cilia fuscous, terminal half fuscous-whitish.

Perth and Albany, West Australia; in November and December; five specimens. Generally, but not always, the contrast between the light median area and the dark basal and hindmarginal areas is very conspicuous.

46. *Dichr. poecilotis*, n.sp.

♂♀. 21-24 mm. Head pale reddish-ochreous on crown, with a few dark fuscous and whitish scales, face whitish irrorated with dark fuscous. Palpi $2\frac{1}{2}$, dark fuscous, towards base white beneath, extreme apex white. Antennæ grey, pectinations 4. Thorax grey, mixed with light ochreous, and irrorated with whitish and a few blackish scales. Abdomen pale grey, sprinkled with dark grey. Legs grey, femora and posterior tibiæ sprinkled with whitish. Forewings triangular, hindmargin rounded, waved; fuscous, towards costa and on basal area sprinkled with whitish; veins, except costal branches, marked with rather thick light reddish-ochreous streaks, interrupted by lines; a blackish mark in disc near base; a curved cloudy blackish transverse line near beyond this; lines slender, whitish; first from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, posteriorly blackish-margined, acutely angulated outwards in middle, sinuate inwards above middle; second from about $\frac{2}{3}$ of costa to $\frac{2}{3}$ of inner margin, posteriorly blackish-margined, rather abruptly sinuate inwards above inner margin; a small transverse-oval blackish spot in disc above middle; a fine straight dark fuscous line near beyond second, interrupted by streaks on veins; subterminal formed by whitish irroration, posteriorly hardly defined, anteriorly sharply margined by a thick cloudy dark fuscous shade, deeply sinuate inwards above and below middle; a hindmarginal series of small blackish triangular subconfluent spots: cilia fuscous, irrorated with whitish. Hindwings with hindmargin rounded; fuscous; a faint darker median line; cilia light fuscous, tips more whitish.

Carnarvon and Geraldton, West Australia, in October and November; common.

47. *Dichr. ioneura*, n.sp.

♂♀. 20-25 mm. Head pale reddish-ochreous, face grey-whitish sprinkled with blackish. Palpi $2\frac{1}{2}$, blackish-fuscous, towards base white beneath, upper edge sprinkled with white. Antennæ grey, pectinations 3. Thorax grey, sprinkled with whitish, and spotted with light reddish-ochreous. Abdomen pale grey, ochreous-tinged, sprinkled with dark grey. Legs dark grey, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin rounded; fuscous, densely irrorated with whitish; veins, except costal branches, marked with rather thick light reddish-ochreous streaks, interrupted by lines; a light reddish-ochreous transverse mark near base; a dark fuscous transverse line about $\frac{1}{4}$, angulated beneath costa; first and second lines whitish on veins, but very obscure and interrupted; first from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, interruptedly margined posteriorly with dark fuscous, obtusely angulated outwards beneath costa; second from about $\frac{2}{3}$ of costa to $\frac{2}{3}$ of inner margin, interruptedly margined anteriorly with dark fuscous, somewhat irregular, sinuate inwards towards inner margin; a small transverse dark fuscous spot in disc above middle; a dark fuscous line beyond second, interrupted by streaks on veins, sinuate outwards in middle; subterminal only indicated by cloudy dark fuscous anterior margin, somewhat irregular, tending to be interrupted: cilia fuscous sprinkled with whitish, tips fuscous-whitish. Hindwings with hindmargin rounded; fuscous, somewhat darker posteriorly; cilia fuscous, tips fuscous-whitish.

Perth, West Australia, in October and November; rather common.

48. *Dichr. steropias*, n.sp.

♂♀. 21-24 mm. Head and thorax fuscous irrorated with whitish, with a few dark fuscous scales. Palpi 4-6, grey, more or less mixed with whitish and dark fuscous. Antennæ grey, pectinations 4. Abdomen ochreous-whitish, more or less irrorated with grey. Legs dark fuscous, sprinkled with whitish, apex of joints whitish. Forewings elongate-triangular, hindmargin

rounded; fuscous, densely irrorated with whitish, and with scattered dark fuscous scales, more or less irregularly suffused in disc with whitish-ochreous; four small tufts of raised scales, blackish on anterior side, first beneath costa near base, second beneath costa at $\frac{1}{4}$, third in disc before middle, fourth in disc above middle; lines slender, dark fuscous; first from $\frac{1}{4}$ of costa to $\frac{1}{3}$ of inner margin, irregular, acutely angulated outwards in middle, passing through second tuft, and angle terminating in third; second line from $\frac{4}{5}$ of costa to $\frac{3}{4}$ of inner margin, nearly straight, sharply dentate throughout; subterminal obscurely paler, subdentate, anteriorly margined by a straight cloudy dark fuscous shade running from apex to before anal angle; an interrupted black hindmarginal line: cilia fuscous, irrorated with whitish. Hindwings with hindmargin rounded; fuscous, sometimes paler and tinged with whitish-ochreous; an indistinct darker discal dot; a cloudy dark fuscous hindmarginal line; cilia light fuscous, sprinkled with whitish, sometimes whitish-ochreous.

Geraldton and Perth, West Australia, in November; three specimens. An eccentric species, specially characterised by the tufts on surface of forewings; the unusually long palpi are also unusually variable in length, and the same peculiarity may be observed in *D. consignata.*

49. *Dichr. orectis*, n.sp.

♂♀. 20-23 mm. Head and thorax pale ochreous or greyish, densely and suffusedly irrorated with whitish, sometimes with scattered blackish scales. Palpi $2\frac{1}{2}$, dark fuscous, towards base white beneath, upper edge sprinkled with white. Antennæ grey, pectinations 5. Abdomen pale greyish-ochreous, sprinkled with dark fuscous. Legs dark fuscous, apex of joints whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin rounded; fuscous or light fuscous, densely irrorated with whitish and sprinkled with black; a blackish dot or transverse mark beneath costa near base; first line obscurely whitish, from before $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, posteriorly margined with blackish, sometimes very thickly, nearly straight, slightly

indented in middle; a small transverse spot outlined with blackish in disc above middle; second line obscurely whitish, from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, margined anteriorly with a series of small triangular blackish spots, sometimes confluent into a more or less thick black shade, rather sharply angulated outwards in middle, sinuate inwards above middle and more deeply on lower half, central angle marked with a small more or less distinct reddish-ochreous spot; subterminal cloudy, whitish, subdentate, rather irregular, anteriorly margined by a more or less distinct dark grey or blackish shade; a hindmarginal series of triangular black dots: cilia fuscous-whitish, with obscure fuscous bars, and a somewhat interrupted cloudy dark fuscous median line. Hindwings with hindmargin rounded; fuscous, posteriorly darker; a faint darker discal mark; cilia fuscous, terminal half fuscous-whitish.

Geraldton, West Australia; in November and December, common; a variable species. Larva 10-legged, cylindrical; bright green; spiracular line and segmental incisions pale yellowish, partly marked with white; a series of oblique white marks on sides meeting on back: feeds in November on a Myrtaceous shrub of which I failed to obtain the name, resembling *Leptospermum* in habit, with small diamond-shaped leaves crowded and appressed to stem in long shoots: pupa in a slight cocoon. The above larval description is incomplete; the larva is marked and coloured in beautiful imitation of the leafy stems of its food plant, the oblique white lateral lines expressing the outlines of the small crowded stem-clasping leaves.

50. *Dichr. atrosignata*, Walk.

(*Panagra atrosignata*, Walk. 1006; *Eubolia linda*, Butl. Ann. Mag. 1882, 96.)

♂. 18-19 mm. Head and thorax dark fuscous. Palpi $3\frac{1}{2}$, rather dark fuscous, upper edge sprinkled with whitish. Antennæ fuscous, pectinations 6. Abdomen whitish-fuscous irrorated with dark fuscous. Legs dark fuscous, femora and posterior tibiæ irrorated with whitish-ochreous. Forewings triangular, hind-

margin bowed; fuscous, suffusedly irrorated with whitish-fuscous and coarsely sprinkled with dark fuscous; lines obscurely paler; first from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of inner margin, posteriorly margined with dark fuscous or sometimes strongly with blackish, hardly curved; second from beyond $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, anteriorly margined with dark fuscous or sometimes strongly with blackish, slightly irregular, slightly curved outwards on upper half and inwards on lower half; a small transverse dark fuscous sometimes paler-centred spot in disc above middle; subterminal hardly paler, subdentate, anteriorly suffusedly margined with darker fuscous; a hindmarginal row of triangular subconnected black dots: cilia pale whitish-fuscous, with a cloudy fuscous line. Hindwings with hindmargin rounded; fuscous; a faint darker discal dot; a faint curved paler line at $\frac{2}{3}$; an interrupted dark fuscous hindmarginal line; cilia as in forewings.

♀. 23-25 mm. Differs from ♂ as follows: forewings irrorated with whitish; lines broadly margined with blackish on discal side, except towards costa; discal spot very small or dot-like; second line from $\frac{3}{4}$ of costa, rather sharply angulated in middle, sinuate inwards above middle, and more strongly curved and somewhat bent inwards on lower half; cilia light fuscous irrorated with whitish.

Sydney, New South Wales; from August to October, and in March and April, common. The variability in the intensity of marking, and the sexual differences make this at first sight rather a perplexing species.

51. *Dichr. euscia*, n.sp.

♂. 25 mm. Head and thorax dark fuscous, finely sprinkled with whitish. Palpi 3, dark fuscous, upper edge sprinkled with whitish. Antennæ grey, pectinations 3. Abdomen fuscous-whitish irrorated with dark fuscous. Legs dark fuscous, femora and posterior tibiæ sprinkled with whitish. Forewings triangular, hindmargin bowed; fuscous, densely irrorated with whitish and sprinkled with dark fuscous; a blackish dot on costa at $\frac{2}{5}$, a second in disc at $\frac{2}{5}$, and a third above inner margin at $\frac{1}{3}$; a small blackish

dot in disc above middle; second line hardly perceptibly paler, from $\frac{3}{4}$ of costa to $\frac{2}{3}$ of inner margin, anteriorly margined by a blackish dot on costa, and on lower $\frac{3}{4}$ by a thick black streak shading into fuscous anteriorly, obtusely angulated outwards in middle, slightly sinuate above middle, gently and evenly curved inwards on lower half; subterminal hardly paler, rather irregular, anteriorly suffusedly margined with darker: cilia fuscous, basal half irrorated with whitish, terminal half whitish-fuscous. Hindwings with hind margin rounded, apex somewhat prominent; fuscous, somewhat lighter towards base; cilia fuscous, towards tips whitish-fuscous.

Blackheath (3500 feet), New South Wales; in October and November, two specimens.

52. *Dichr. ophiucha*, n.sp.

♂. 21 mm. Head and thorax rather dark fuscous, finely irrorated with whitish. Palpi almost 4, fuscous irrorated with dark fuscous, upper edge sprinkled with whitish. Antennæ grey, pectinations 5. Abdomen whitish-fuscous. Legs dark fuscous sprinkled with whitish. Forewings triangular, hindmargin bowed; fuscous, finely irrorated with whitish; a short blackish mark beneath costa almost at base; a short outwardly oblique blackish streak from costa at $\frac{1}{3}$; a short longitudinal blackish streak in middle of disc; an obscure cloudy darker dot on costa at $\frac{3}{4}$: cilia fuscous sprinkled with whitish. Hindwings with hindmargin rounded; pale whitish-fuscous, slightly ochreous-tinged; cilia fuscous-whitish.

Sydney, New South Wales; in August and November, two specimens.

53. *Dichr. indicataria*, Walk.

(*Eubolia indicataria*, Walk. Suppl. 1698.)

♂♀. 17-20 mm. Head and thorax rather dark fuscous, finely and densely irrorated with whitish. Palpi $2\frac{1}{2}$, dark fuscous, upper edge sprinkled with white. Antennæ grey, pectinations 4. Abdomen ochreous-grey-whitish, irrorated with dark grey. Legs dark fuscous, finely sprinkled with whitish. Forewings triangular,

hindmargin rounded, waved; fuscous, finely and densely irrorated with whitish; lines slightly paler; first from $\frac{2}{5}$ of costa to $\frac{2}{5}$ of inner margin, posteriorly finely dark-margined, sometimes with blackish, nearly straight, rather irregular; second from $\frac{2}{3}$ of costa to $\frac{2}{3}$ of inner margin, anteriorly finely margined with darker or sometimes with blackish, very slightly curved outwards on upper $\frac{2}{3}$, shortly dentate throughout; included median space sometimes suffused with dark fuscous, without whitish irroration; a fine blackish small transverse-oval ring in disc above middle; subterminal hardly paler, posteriorly faintly, anteriorly more distinctly dark-margined, twice slightly sinuate; a blackish waved hindmarginal line: cilia fuscous irrorated with whitish, with obscure indications of darker fuscous bars. Hindwings with hindmargin rounded; fuscous; a faint darker discal dot; cilia fuscous, with a cloudy darker median line, base and tips sprinkled with whitish.

Melbourne, Victoria; Geraldton and Perth, West Australia; from October to December, common.

54. *Dichr. molybdaria*, Gn.

(*Panagra molybdaria*, Gn. X. 131; *P. carbonata*, Walk. 1004.)

♂♀. 20-25 mm. Head and thorax dark fuscous irrorated with whitish. Forewings fuscous, irrorated with whitish, thinly sprinkled with black; lines dark fuscous; first somewhat irregular, from before middle of costa to before middle of inner margin, sinuate outwards beneath costa; second markedly denticulate throughout, from before $\frac{3}{4}$ of costa to before $\frac{3}{4}$ of inner margin, somewhat curved outwards and more dentate on central third, marked with a more or less distinct reddish-ochreous spot in middle; included median space often suffused with dark slaty-grey except on costa, but in paler specimens a dark grey discal dot visible; subterminal slightly paler, waved, preceded by a slightly darker shade; a widely interrupted fine blackish hindmarginal line; cilia pale grey. Hindwings fuscous-grey or light grey.

Said to be from Sydney, New South Wales; five specimens in British Museum Collection, from which this diagnosis is taken, as I have seen no others.

55. *Dichr. estigmaria*, Walk.

(*Panagra estigmaria*, Walk. 1001; *P. costinotata*, ib. 1001, *Acidalia schistacearia*, ib. 1609.)

♂♀. 22-24 mm. Head and thorax greyish-ochreous irrorated with whitish. Palpi 2½, brownish-ochreous, upper edge sprinkled with white, extreme tip white. Antennæ light ochreous spotted with whitish, pectinations 7. Abdomen whitish-ochreous sprinkled with dark fuscous. Legs light brownish-ochreous, posterior tibiæ in ♂ dilated, enclosing tuft of hair of hairs in groove, posterior tarsi in ♂ less than half tibiæ. Forewings triangular, hindmargin bowed; light brownish-ochreous, greyish-ochreous, or pale fuscous, finely irrorated with ochreous-whitish; lines hardly perceptibly paler; first from before middle of costa to before middle of inner margin, angulated immediately beneath costa, where it is margined posteriorly by one or two blackish dots, and sinuate inwards in middle and above inner margin, with a blackish dot on posterior margin in each sinuation; a fuscous dot in disc above middle; second line from ¾ of costa to before ¾ of inner margin, hardly curved, sinuate inwards above and below middle, with a slight bidentate projection outwards in middle, anteriorly margined with indistinct sometimes subconnected blackish dots, sometimes with a small blackish or partly ferruginous spot on median projection; subterminal hardly perceptibly paler, anteriorly margined by a more or less faint obscure interrupted darker shade, sometimes forming a small cloudy dark fuscous spot on costa; a widely interrupted black hindmarginal line or series of triangular dots: cilia light fuscous sprinkled with yellow-whitish, terminal half fuscous-whitish. Hindwings with hindmargin rounded; pale fuscous, sometimes ochreous-tinged; cilia whitish-fuscous, tips paler.

Sydney and Blackheath (3500 feet), New South Wales; from October to December, and in February, common. The abbreviated posterior tarsi of the ♂ are a notable special characteristic.

56. *Dichr. ornata*, Walk.

(*Panagra ornata*, Walk. 1004.)

♂♀. 20-21 mm. Head and thorax dark ashy-fuscous. Palpi $2\frac{1}{2}$, dark fuscous, upper edge sprinkled with whitish. Antennæ grey, pectinations 6. Abdomen whitish-grey, irrorated with dark grey. Legs dark fuscous, femora sprinkled with whitish. Forewings triangular, hindmargin bowed; fuscous, finely irrorated with whitish and sprinkled with dark fuscous; a hardly curved series of four blackish dots from $\frac{2}{5}$ of costa to $\frac{2}{5}$ of inner margin; an obscure dark fuscous dot in disc above middle; second line hardly perceptibly paler, from $\frac{4}{5}$ of costa to $\frac{3}{4}$ of inner margin, nearly straight, gently sinuate outwards below costa and in middle, anteriorly edged with a series of blackish dots or sometimes with a thick anteriorly suffused dark fuscous shade; a faint paler subdentate subterminal line, very obscurely edged with darker anteriorly; an interrupted black hindmarginal line: cilia fuscous, sprinkled with whitish. Hindwings with hindmargin rounded; fuscous; a faint paler anteriorly darker-edged sinuate line beyond middle, more distinct towards inner margin; a dark fuscous hindmarginal line; cilia fuscous, sprinkled with whitish.

Sydney and Blackheath (3500 feet), New South Wales; from September to November, and in March, common.

57. *Dichr. ischnota*, n.sp.

♀. 18-19 mm. Head and thorax fuscous, densely irrorated with whitish. Palpi 3, ochreous-fuscous, towards base white beneath, upper edge sprinkled with white, extreme apex white. Antennæ grey spotted with whitish. Abdomen whitish sprinkled with dark fuscous. Legs fuscous sprinkled with whitish. Forewings rather elongate-triangular, hindmargin bowed; fuscous, densely irrorated with whitish and less densely with dark fuscous; lines very obscurely whitish; first from before middle of costa to before middle of inner margin, sharply angulated outwards beneath costa, posteriorly more or less distinctly edged with dark fuscous; second from $\frac{4}{5}$ of costa to $\frac{3}{4}$ of inner margin, slightly sinuate

inwards above middle and more strongly on lower half, anteriorly more or less distinctly margined with dark fuscous; included median space with lower half sometimes ochreous-fuscous mixed with blackish, without white irroration; an obscure whitish subdentate twice sinuate subterminal line, anteriorly suffusedly margined with dark fuscous; an interrupted blackish hindmarginal line: cilia fuscous, sprinkled with whitish. Hindwings with hindmargin rounded; fuscous; a faint paler sinuate line at $\frac{2}{3}$; an interrupted dark fuscous hindmarginal line; cilia fuscous, sprinkled with whitish.

Carnarvon, West Australia, in October; two specimens.

58. *Dichr. triparata*, Walk.

[*Panagra triparata*, Walk. 1005; *P. molybdaria*, ib. 995 (nec Gn.).]

♂♀. 20-22 mm. Head and thorax dark ashy-fuscous with a few blackish scales. Palpi 3¼, dark fuscous, base slightly sprinkled with whitish. Antennæ grey, pectinations 3½. Abdomen whitish-fuscous, suffusedly irrorated with dark grey. Legs dark fuscous, apex of joints whitish, femora and posterior tibiæ irrorated with whitish. Forewings triangular, hindmargin waved, bowed; fuscous, finely irrorated with whitish and sprinkled with dark fuscous; three nearly straight cloudy indistinct dark fuscous lines between base and first line, central one broad, other two very slender; first and second lines cloudy, blackish, less marked towards costa; first from before middle of costa to middle of inner margin, straight; second from $\frac{2}{3}$ of costa to before $\frac{2}{3}$ of inner margin, forming a short angular projection in middle, slightly sinuate inwards above and more strongly below this; included median space almost without whitish irroration, forming a narrow dark band, on lower half sometimes suffused with blackish; a blackish linear transverse mark in disc above middle; a slender cloudy dark fuscous line near beyond and parallel to second line, more sinuate outwards beneath costa, marked with a cloudy ochreous spot in middle; subterminal slender, obscure, whitish, rather irregular, margined by suffused darker shades; an obscure

brownish-ochreous suboblique dash from hindmargin beneath apex, appearing to enclose with subterminal line a more whitish diamond-shaped apical spot; a waved black hindmarginal line: cilia fuscous, basal half sprinkled with whitish, tips whitish. Hindwings with hindmargin rounded; fuscous, towards hindmargin rather darker; three short whitish dark-margined streaks from inner margin above anal angle; a dark fuscous hindmarginal line; cilia fuscous, with some whitish points.

Sydney, New South Wales; Melbourne, Victoria; Albany, West Australia; from August to December, common.

59. *Dichr. consignata*, Walk.

(*Panagra consignata*, Walk. 1006; *P. petrilineata*, ib. 1008.)

♂♀. 22-25 mm. Head and thorax dark fuscous densely irrorated with white. Palpi $3\frac{1}{2}$-5, fuscous irrorated with dark fuscous, upper and lower margins irrorated with white. Antennæ grey, pectinations $4\frac{1}{2}$. Abdomen pale whitish-fuscous, with a few dark fuscous scales. Legs dark fuscous irrorated with white. Forewings triangular, hindmargin bowed; fuscous, very densely irrorated with white, and with scattered dark fuscous scales; lines moderately broad, obscurely whitish, margined on both sides with dark fuscous; first from before middle of costa to before middle of inner margin, slightly sinuate outwards on upper half and inwards on lower half, margins more or less strongly thickened on lower half; second from $\frac{5}{6}$ of costa to $\frac{3}{4}$ of inner margin, sinuate inwards above middle and again below middle; a small narrow transverse blackish spot in disc above middle; subterminal obscurely whitish, terminating above in apex, more or less strongly sinuate outwards in middle, anteriorly rather strongly margined and sinuation filled with blackish, separated from second line by a light ochreous shade becoming whitish towards costa, posteriorly suffusedly margined with dark fuscous; a waved black hindmarginal line: cilia fuscous, densely irrorated with white, tips more or less white. Hindwings with hindmargin slightly rounded, apex somewhat prominent; light fuscous; an obscure darker discal dot; some-

times a faint paler line at $\frac{2}{3}$; a dark fuscous hindmarginal line; cilia fuscous, base paler, terminal half sprinkled with whitish.

Bathurst (2500 feet), New South Wales; Perth and Albany, West Australia; from October to December, common.

60. *Dichr. stilbiata*, Gn.

(*Liodes stilbiata*, Gn. X. 120, pl. XVIII. 4; *Panagra plusiata*, Walk. 1007.)

♂♀. 23-28 mm. Head and thorax dark fuscous, more or less sprinkled with whitish. Palpi 2, dark fuscous, upper edge sprinkled with whitish. Antennæ grey, pectinations 5. Abdomen pale whitish-fuscous, sprinkled with fuscous. Legs dark fuscous, femora irrorated with whitish, posterior tibiæ in ♂ with tuft of hairs enclosed in groove. Forewings triangular, hindmargin rounded; rather dark fuscous, densely irrorated with white on basal area and more or less partially in disc and posteriorly, except towards costa; veins partially and irregularly marked with black in disc and posteriorly; a cloudy dark fuscous transverse mark at $\frac{1}{5}$, not reaching margins; first line obscurely whitish, from before middle of costa to $\frac{2}{5}$ of inner margin, angulated outwards beneath costa but generally indistinct, posteriorly margined on lower half with blackish; a small narrow transverse blackish spot in disc above middle; base of veins 3 and 4 forming a small triangular black spot before second line; second line cloudy, white, broader towards costa, from $\frac{4}{5}$ of costa to $\frac{3}{4}$ of inner margin, bent-sinuate inwards above inner margin, anteriorly irregular-edged, posteriorly separated by a fine dark fuscous line from a cloudy parallel fine indistinct whitish line; subterminal indistinct, cloudy, whitish, subdentate, terminating above in apex, abruptly sinuate outwards below middle; hindmargin suffused with whitish; a waved black hindmarginal line: cilia whitish barred with fuscous, with an ill-defined fuscous median line. Hindwings with hindmargin rounded; fuscous; a faint darker discal dot; a very faint paler line at $\frac{2}{3}$; a dark fuscous hindmarginal line; cilia as in forewings, but fuscous-tinged and more obscure.

Sydney, Blackheath (3500 feet), and Mount Kosciusko (5000 feet), New South Wales; Melbourne, Victoria; Deloraine and Hobart, Tasmania; Mount Lofty, South Australia; from October to February, common.

61. *Dichr. confluaria*, Gn.

(*Panagra confluaria*, Gn. X. 131, pl. VII. 8.)

♂♀, 24-32 mm. Head dark fuscous irrorated with white. Palpi $3\frac{1}{4}$, dark fuscous, towards base white beneath, upper edge white. Antennæ grey, pectinations 6. Thorax dark fuscous, shoulders and a posterior spot whitish. Abdomen whitish-ochreous, more or less sprinkled with dark fuscous. Legs dark fuscous, femora sprinkled with whitish. Forewings triangular, hindmargin rounded; dark fuscous; a cloudy white streak beneath costa from base, reaching costa before apex; first line white, from before middle of costa to $\frac{1}{4}$ of inner margin, very acutely angulated outwards on subcostal streak, so as to reach $\frac{3}{5}$, upper portion slender, lower broad and containing a central cloudy ochreous line, rather sinuate inwards above inner margin; second line from $\frac{5}{6}$ of costa to $\frac{4}{5}$ of inner margin, fuscous-ochreous, margined on both sides with white throughout, slightly angulated outwards above middle, thence to inner margin moderately curved inwards; subterminal nearly straight, cloudy, white; a white streak along hindmargin from apex to anal angle; a black hindmarginal line: cilia fuscous, basal half sometimes sprinkled with whitish, terminal half whitish with faint fuscous bars. Hindwings with hindmargin slightly rounded, apex rather prominent; pale fuscous; an obscure darker discal dot; a faint paler anteriorly darker-edged line at $\frac{2}{3}$, and traces of two extremely faint similar lines between this and hindmargin; a dark fuscous hindmarginal line; cilia as in forewings.

Blackheath (3500 feet), New South Wales; Melbourne, Victoria; Deloraine, Tasmania; Albany, West Australia; from October to December, common.

62. *Dichr. personalis*, Feld.

(*Colobochila personalis*, Feld. pl. cxx. 20.)

♂♀. 24-29 mm. Head whitish or whitish-fuscous. Palpi 2½-3, dark fuscous, upper edge white. Antennæ grey-whitish, pectinations 5. Thorax white, collar and patagia fuscous-tinged, apex and inner side of patagia blackish. Abdomen fuscous-whitish, sprinkled with dark fuscous. Legs fuscous, femora and posterior tibiæ dark fuscous irrorated with paler, posterior tibiæ of ♂ dilated, enclosing tuft of hairs in groove. Forewings somewhat elongate-triangular, hindmargin slightly rounded; pale whitish-fuscous, with a few scattered dark fuscous scales; dark markings margined with whitish-ochreous; a slender cloudy dark fuscous streak along costa throughout; a rather large elongate-triangular blackish spot in middle of disc; a broad blackish subdorsal streak from base of inner margin to anal angle, lower edge straight, leaving a narrow dorsal streak of groundcolour, upper edge with a broad triangular projection before middle, and posteriorly triangularly dilated to coalesce with a narrow subterminal fascia from near apex, of which the anterior edge is slightly sinuate, posterior edge triangularly dilated in middle, upper extremity attenuated; a fine dark fuscous hindmarginal line: cilia grey-whitish, with a cloudy fuscous line. Hindwings with hindmargin slightly rounded, apex somewhat prominent; fuscous; a darker discal dot; a sinuate obscurely darker posterior line; cilia fuscous.

Perth and Albany, West Australia, in November and December; in swampy thickets, common.

7. OENONE, n.g.

Face clothed with long fine erect hairs. Tongue developed. Antennæ in ♂ filiform, simple. Palpi moderate, subascending, rather slender, with appressed scales, clothed with long fine projecting hairs. Thorax with fine erect hairs above, densely hairy beneath. Forewings with vein 10 connected by bar with 9. Hindwings with veins 6 and 7 approximated at base or short-stalked.

Doubtless an early type, having near relationship to *Dichromodes* on the one hand and the European genus *Brephos* on the other. It would appear to have been brought into close competition with the ancestors of *Dichromodes*, and to have been worsted, surviving only in the mountains of Tasmania. Similarly *Brephos* has only maintained itself in Europe by becoming adapted to the wintry climate of the earliest spring.

Hindwings orange......... .... 63. *solaris*.
Hindwings dark fuscous, with a white blotch... 64. *lunaris*.

63. *Oen. solaris*, n.sp.

♂. 23 mm. Head blackish, face and sides whitish. Palpi whitish, mixed with blackish hairs. Antennæ blackish. Thorax and abdomen blackish, with a few white scales on segmental margins. Legs dark fuscous, apex of joints whitish. Forewings elongate-triangular, costa slightly sinuate, hindmargin rounded; ochreous-fuscous, densely and suffusedly irrorated with blackish-fuscous; several short longitudinal pale yellowish marks in disc towards base; first line thick, cloudy, blackish-fuscous, from $\frac{1}{3}$ of costa to before middle of inner margin, somewhat curved; an obscure whitish dot in disc, suffusedly margined with darker; second line whitish, becoming fuscous-tinged beneath, suffusedly dark-margined, from $\frac{3}{4}$ of costa to $\frac{3}{4}$ of inner margin, waved, slightly outwards-curved, slightly sinuate near inner margin; an irregular fine subterminal line indicated by whitish scales: cilia fuscous mixed with dark fuscous (imperfect). Hindwings with hindmargin rounded; bright deep reddish-orange; some blackish scales towards costa; a narrow blackish band from apex along hindmargin to anal angle, where it is extremely slender, thence along inner margin to base where it is suffusedly dilated; cilia whitish-fuscous mixed with blackish.

Mount Wellington (3500 feet), Tasmania, in December; one specimen.

64. *Oen. lunaris*, n.sp.

♂. 21-23 mm. Head blackish, with some yellow-whitish scales, face yellow-whitish. Palpi whitish, mixed with blackish hairs.

Antennæ blackish. Thorax blackish, patagia and posterior margin sprinkled with pale ferruginous. Abdomen blackish, segmental margins with some white scales. Legs dark fuscous. Forewings elongate-triangular, costa slightly sinuate, hindmargin rounded; dark fuscous mixed with blackish, and sprinkled with pale ferruginous; lines obscure, formed by a whitish irroration; first from $\frac{1}{4}$ of costa to $\frac{2}{5}$ of inner margin, posteriorly suffusedly dark-margined, moderately curved; second from $\frac{2}{3}$ of costa to $\frac{3}{4}$ of inner margin, anteriorly suffusedly dark-margined, rather irregular, somewhat sinuate outwards in middle and inwards above inner margin; subterminal irregular, preceded by a darker suffusion: cilia dark fuscous, with indistinct bars formed by a whitish irroration. Hindwings with hindmargin rounded; rather dark fuscous; a large cloudy white somewhat trapezoidal blotch occupying whole of disc; cilia rather dark fuscous; tips whitish.

Mount Wellington (4100 feet), Tasmania; common, flying freely over the rocky ground on the extreme summit, in December.

8. ASPILATES, Tr.

Face smooth. Tongue developed. Antennæ in ♂ bipectinated throughout. Palpi moderate, porrected, shortly rough-scaled or with rather appressed scales. Thorax sometimes hairy beneath. Forewings with vein 10 anastomosing or connected by bar with 9 or separate. Hindwings with veins 6 and 7 stalked or approximated at base.

The species referred by Lederer to this genus are heterogeneous in character, some of them not even belonging to this family; I have restricted the genus to those whose structure is as above. It then consists only of some half dozen European and Asiatic species, representing perhaps the fragments of a formerly more numerous group.

65. *Asp. chordota*, n.sp.

♂. 32 mm. Head dark fuscous. Palpi white, externally dark fuscous except on basal joint. Antennæ white. Thorax hairy beneath, dark fuscous, anterior margin, and inner margin of

patagia white. Abdomen whitish. Legs dark fuscous, posterior tibiæ white. Forewings very elongate-triangular, hindmargin rather obliquely rounded, somewhat waved; 10 connected with 9 by bar; dark fuscous, ochreous-tinged; all veins and submedian fold marked with rather strong white lines; an indistinct transverse whitish line rather near and parallel to hindmargin: cilia white. Hindwings with hindmargin somewhat bent on vein 3, anal angle rather prominent; 6 and 7 approximated at base; whitish; a crescentic grey discal spot; a moderate hindmarginal band slightly fuscous-tinged; a fuscous hindmarginal line; cilia white.

Melbourne, Victoria; one specimen (Coll. Lucas). A very distinct and interesting species.

9. Eumelea, Jard.

Face with slight projection of scales. Tongue developed. Antennæ long ($\frac{5}{6}$ or almost 1), in ♂ filiform, simple. Palpi moderately long, ascending, second joint rough-scaled, terminal joint rather slender, cylindrical, porrected. Thorax, femora, and posterior tibiæ hairy beneath. Forewings with vein 11 anastomosing first with 12 and then strongly with 10. Hindwings with veins 6 and 7 stalked.

A small Indo-Malayan genus, of which one wide-ranging species extends into the tropical regions of Australia. The slenderness and length of the legs and antennæ give it an abnormal appearance in this group. It may probably be regarded as a special development from the neighbourhood of *Aspilates;* I have an undescribed closely allied genus from Burmah which possesses unipectinated antennæ in the ♂.

66. *Eum. rosalia,* Cr.

(*Eumelea rosalia,* Cr., Gn. IX. 392.)

♂. 48-54 mm. Head yellow, spotted with crimson-red. Palpi crimson, beneath yellow. Antennæ whitish-ochreous, becoming crimson towards base. Thorax light yellow, anterior margin crimson. Abdomen light yellow, suffusedly irrorated with light

crimson. Legs pale yellowish, femora and tibiæ partly crimson. Forewings somewhat elongate-triangular, hindmargin slightly rounded; light yellow, densely strewn with short suffused ferruginous-orange sometimes crimson-tinged transverse strigulæ; the yellow colour often forms a small clear spot at apex, and sometimes others above and below disc beyond middle, and in middle of hindmargin; costa finely strigulated with dark purplish-fuscous, on basal fourth suffused with purplish; a curved transverse purplish-crimson streak from $\frac{1}{4}$ of costa to before $\frac{1}{3}$ of inner margin, sometimes nearly obsolete; a slightly curved transverse purplish-crimson streak from beyond middle of costa to beyond middle of inner margin; a more or less perceptible variable purplish-crimson subterminal fascia: cilia purplish-crimson, sometimes marked with yellow dots. Hindwings with hindmargin waved, rounded; colour and markings as in forewings, but costal strigulæ and first transverse streak absent; second transverse streak central, straight.

Townsville and Cairns, Queensland; three specimens. Also from New Guinea, the Solomon Islands, and Ceylon.

10. Xenomusa, n.g.

Face smooth. Tongue developed. Antennæ in ♂—? Palpi very short, porrected, rough-scaled. Forewings with vein 10 out of 9. Hindwings with veins 6 and 7 approximated at base, 8 fused with cell at a point near base.

The ♂ is unfortunately unknown; I suspect, however, that the antennæ may be unipectinated. The genus is peculiar, but affords a valuable connecting link between the preceding and following groups.

67. *Xen. monoda*, n.sp.

♀. 41 mm. Head, palpi, antennæ, thorax, abdomen, and legs whitish-ochreous; forehead with an irregular blackish bar, face white; antennæ partially dotted with fuscous; legs ringed with dark fuscous. Forewings somewhat elongate-triangular, costa

sinuate, apex acute, subfalcate, hindmargin deeply sinuate beneath apex, thence bowed; whitish-ochreous, slightly brownish-tinged, strewn with short scattered dark grey transverse strigulæ; a straight cloudy grey streak, somewhat mixed with ochreous, from apex to middle of inner margin, broadest beneath, interrupted near upper extremity, thence to near inner margin marked with a fine cloudy blackish line: cilia rather dark fuscous, tips fuscous-whitish. Hindwings with hindmargin rounded; colour, strigulæ, and cilia as in forewings, but base paler; a straight cloudy fuscous streak, mixed with ochreous and a few blackish scales, from middle of costa to middle of inner margin, posteriorly suffusedly margined with yellow-ochreous, especially towards middle; beyond this suffusion a moderate roundish cloudy fuscous spot in disc above middle, beneath which is an obscure pale dot.

Melbourne, Victoria; one specimen received from Dr. T. P. Lucas, who possesses others.

11. Onychodes, Gn.

Face smooth. Tongue developed. Antennæ in ♂ bipectinated to apex, in ♀ also very shortly bipectinated. Palpi short, porrected, rough-scaled. Thorax densely hairy beneath. Forewings with vein 11 anastomosing with 12. Hindwings with veins 6 and 7 somewhat approximated at base.

These characters are drawn from *O. lutosaria*, as I have not been able to examine a specimen of *O. traumataria*, which is the type of Guénée's genus; the definition may therefore require modification, or it may even prove that the two species cannot be justly included together. So far as the structural characters are given by Guénée, they appear to agree. I have corrected the erroneous spelling of Guénée's generic name.

Forewings with a dark fuscous spot above anal angle .... 68. *traumataria.*

Forewings without a dark fuscous spot above anal angle.. 69. *lutosaria.*

68. *Onych. traumataria*, Gn.

(*Onycodes traumataria*, Gn. IX. 143, pl. IX. 8.)

♂♀. 35-40 mm. Forewings with costa somewhat concave, apex strongly produced, hindmargin concave beneath apex, bowed; hindwings with hindmargin rounded. Wings rosy-fulvous, cilia reddish-brown or purplish; hindwings suffused with ochreous-yellow on costal half. A median series of more or less distinct dull red spots crosses all the wings, and often forms a narrow fascia on hindwings, which are strewn with longitudinal (?) striæ of the same colour. Forewings with an apical spot mixed with brown, reddish, and white; a similar spot near anal angle, and an obscure costal streak preceding apical spot. The ♀ is more rosy and less yellow, the apical spot sometimes forming the commencement of a dentate line.

Hobart, Tasmania; I have seen a specimen taken by Mr. G. F. Mathew, but unfortunately omitted to describe it at the time. The above description is translated from Guénée, only altering the terminology so far as to make it correspond sufficiently with that used by myself; it is, however, poor and confused. His figure, though not very good, is characteristic, and for the rest the species is easily enough recognisable.

69. *Onych. lutosaria*, Feld.

(*Arhodia lutosaria*, Feld. pl. CXXIV. 15-17.)

♀. 60 mm. Head dark ochreous-fuscous, with a white band above palpi, and a broad whitish-rosy band between antennæ. Palpi rosy, base ochreous-yellow. Antennæ whitish, towards base rosy. Thorax yellow-ochreous, with a rosy spot on shoulders. Abdomen yellow, irrorated with rosy, base more whitish, apex and a dorsal series of pairs of spots rosy. Legs yellow spotted with rosy. Forewings elongate-triangular, costa sinuate, apex acute, strongly produced, hindmargin deeply concave beneath apex, strongly bowed, very oblique beneath; light yellow-ochreous, brownish-tinged, with a few scattered purplish dots; a dark purplish-

fuscous suffusion along basal fifth of costa; three dark purplish-fuscous oblique transverse spots on costa at $\frac{1}{5}$, $\frac{2}{5}$ and $\frac{2}{3}$, and three similar spots on inner margin at $\frac{1}{3}$, $\frac{1}{2}$, and $\frac{2}{3}$; a small dark purplish-fuscous discal spot beyond middle; an oblique dark fuscous streak from apex, suffused above with rosy, and towards apex beneath with a dark grey cloud, with a series of three small dark purplish-fuscous spots between its extremity and third dorsal spot; four dull rosy spots in a transverse series above anal angle, and two others towards hindmargin above middle: cilia rosy. Hindwings with hindmargin rounded; yellow, thinly speckled with rosy; a small round rosy discal spot; inner margin obscurely strigulated with white and black; a short irregular white transverse streak from inner margin at $\frac{2}{3}$, speckled and margined with black, followed beneath by a broad dull fuscous-rosy patch, connected with costa by a double series of rosy dots; cilia yellow, on lower half of hindmargin deep rosy.

♂ smaller, forewings more brownish or rosy-tinged, more uniform; no dorsal spots, discal spot, or subapical streak; markings reduced to costal spots, and two transverse dotted lines.

Fernshaw, Victoria; two specimens (Coll. Lucas). Felder's figures are in this instance good.

12. Arrhodia, Gn.

Face densely scaled. Tongue developed. Antennæ in ♂ bipectinated to apex. Palpi moderate, subascending, second joint rather shortly rough-scaled, terminal joint short. Thorax stout, densely hairy beneath. Anterior tibiæ with subapical hook, posterior tibiæ without middle-spurs, tarsi not spinulose. Forewings with vein 6 from close below 9, 10 free. Hindwings with veins 6 and 7 approximated at base.

Perhaps a development of *Gastrophora;* this and the next four genera form a closely allied group of singular facies and unusually stout build. The generic name is misspelt by Guénée *Arhodia*, which I have corrected.

70. *Arrh. lasiocamparia*, Gn.

(*Arhodia lasiocamparia*, Gn. IX. 186; *A. retractaria*, Walk. 282; *Nigasa subpurpurea*, ib. 287; *Arhodia semirosea*, ib., Trans. Ent. Soc. Lond. I. (3 s.), 267.)

♂♀. 50-62 mm. Head and thorax pale brownish-ochreous, in ♀ more whitish. Palpi whitish. Antennæ whitish, pectinations light ochreous. Abdomen ochreous-whitish, in ♂ more ochreous on back. Legs light ochreous, posterior tibiæ ochreous-whitish, tarsi slightly rosy-tinged. Forewings triangular, in ♀ more elongate, hindmargin nearly straight, oblique, slightly sinuate near apex; pale brownish-ochreous, in ♀ sprinkled with dark purple-fuscous scales; a small cloudy fuscous spot on inner margin beyond middle; a sinuate series of dark purplish dots from $\frac{5}{6}$ of costa to $\frac{3}{4}$ of inner margin, in ♂ indistinct or obsolete: cilia fuscous, at apex and anal angle whitish-ochreous. Hindwings with hindmargin rounded; in ♂ dull reddish or purplish, in ♀ ochreous-whitish, more ochreous-tinged posteriorly and with fine scattered purplish scales; a slightly curved and sinuate cloudy purplish-fuscous line at $\frac{2}{3}$; sometimes a dark fuscous dot in disc before this; cilia ochreous-whitish, in ♂ rosy-tinged. Forewings beneath with a large deep purple-fuscous blotch in disc towards hindmargin.

Sydney, New South Wales; Melbourne and Warragul, Victoria; Mount Lofty, South Australia; six specimens.

13. Gastrophora, Gn.

Face loosely haired. Tongue developed. Antennæ in ♂ strongly bipectinated to apex. Palpi rather short, densely scaled, terminal joint short, thick. Thorax stout, densely hairy beneath. Tarsi not spinulose. Forewings with veins 6 out of 9, 10 connected with 9 by bar. Hindwings with veins 6 and 7 stalked.

Probably a development of *Monoctenia*.

71. *Gastr. henricaria*, Gn.

(*Gastrophora henricaria*, Gn. IX, 187, pl. XXI, 4).

♂. 65 mm. Head white, face grey-whitish, forehead with a thick black transverse line. Palpi white, upper longitudinal half

black. Antennæ and thorax whitish. Abdomen whitish, sometimes purple-blackish on back. Legs white, speckled with black, anterior pair blackish. Forewings elongate-triangular, costa gently arched, hindmargin almost straight, oblique; very pale whitish-grey, slightly ochreous-tinged, or whitish-ochreous; sometimes a black dot near inner margin at $\frac{3}{5}$; a nearly straight strong black line from beyond middle of costa to beyond middle of inner margin: cilia blackish. Hindwings with hindmargin rounded; deep orange; a purplish-black basal patch, outer edge irregular, running from costa towards base to $\frac{2}{3}$ of inner margin; a thick black rather irregular streak from $\frac{2}{3}$ of costa to $\frac{2}{3}$ of inner margin; a tolerably parallel row of small black spots midway between this and hindmargin; cilia whitish. Undersurface pale whitish-grey; forewings with disc orange, and a very large posterior black blotch, containing towards its upper anterior angle two superposed cloudy violet-bluish spots, each including anteriorly a white transverse mark.

♀. 85 mm. Forewings with hindmargin sinuate, with small fine scattered dark grey strigulæ; black line absent; two cloudy fuscous lines, first median, somewhat curved, second at $\frac{3}{4}$, nearly straight.

Melbourne, Victoria; Mount Lofty, South Australia; three specimens.

14. Phallaria, Gn.

Face with dense scales. Tongue developed. Antennæ in ♂ bipectinated to apex. Palpi moderate, subascending, second joint clothed with dense projecting scales, terminal joint moderate, cylindrical. Thorax stout, densely hairy beneath. Anterior tibiæ with small apical spine, all tarsi spinulose. Forewings with vein 10 connected with 9 by bar. Hindwings with veins 6 and 7 approximated at base.

A development of *Monoctenia*.

72. *Phall. ophiusaria*, Gn.

(*Phallaria ophiusaria*, Gn. IX, 186; *Oenochroma quaternaria*, HS. Exot. 541.)

♂♀. 62-75 mm. Head fuscous, with a broad white fillet between antennæ. Palpi whitish-fuscous. Antennæ whitish, pectinations fuscous. Thorax fuscous, posteriorly more whitish-fuscous. Abdomen whitish-fuscous. Legs whitish-fuscous spotted with dark fuscous. Forewings rather elongate-triangular, hindmargin slightly sinuate beneath apex, thence strongly bowed; fuscous, strewn with numerous small darker transverse strigulæ, sometimes tinged with reddish-brown; costal edge sometimes very narrowly white; three or four small cloudy darker spots forming a curved series at $\frac{1}{3}$; a short transverse linear transparent whitish mark in disc, margined with blackish; an indistinct straight slender fuscous-whitish streak from beyond middle of inner margin towards apex but not quite reaching it, posteriorly obscurely margined with darker and with a series of cloudy dark fuscous dots, sometimes followed by a reddish-brown streak: cilia reddish-brown, terminal third blackish. Hindwings with hindmargin waved, rounded; colour and cilia as in forewings; a straight transverse streak as in forewings, but running from middle of costa to middle of inner margin.

Sydney and Bathurst (2500 feet), New South Wales; Warragul, Victoria; Mount Lofty, South Australia; four specimens. I once possessed, but failed to rear, what I have been told was the larva of this species; a large 12-legged dull brown larva, feeding on *Leptospermum* and *Kunzea*; it was exceedingly sluggish in habit.

15. Monoctenia, Gn.

Face with dense protuberant scales. Tongue developed. Antennæ in ♂ unipectinated, towards apex simple. Palpi moderate, subascending, second joint clothed with dense projecting scales, terminal joints subovate. Thorax stout, densely hairy beneath. Anterior tibiæ in ♂ with apical hook, all tarsi spinulose. Forewings with vein 10 connected with 9 by bar. Hindwings with veins 6 and 7 approximated at base.

The genus is at present confined to Australia. The species are very retired in habit in the imago state, and it is not unlikely

that their number may yet be considerably increased by rearing the larvæ, of which little is known. I have been able to obtain very few specimens for examination, and as they appear often to vary considerably in colour, the descriptions here given may prove incomplete.

1. Hindwings with hindmargin crenate, at least in part	2.
Hindwings with hindmargin crenate, at most waved	3.
2. Pale postmedian line dentate	77. *smerintharia.*
Pale postmedian line not dentate	75. *digglesaria.*
3. Hindwings with hindmargin almost straight	4.
Hindwings with hindmargin rounded	5.
4. Wings rosy, with a straight pale postmedian line	74. *vinaria.*
Wings ochreous-grey, without pale line	79. *subustaria.*
5. Forewings with a large darker triangular costal blotch	78. *falernaria.*
Forewings without a large darker triangular costal blotch	6.
6. Forewings with three nearly straight reddish lines	73. *ochripennata.*
Forewings without three nearly straight reddish lines	76. *obtusata.*

73. *Mon. ochripennata*, Walk.

(*Phallaria ochripennata*, Walk. 284; *Diamuna gastropacharia*, ib. 289.)

♂♀. 55 mm. Head and thorax fuscous. Forewings formed nearly as in *M. falernaria*, but hindmargin entire; fuscous; a faint rosy straight line from $\frac{1}{3}$ of costa to $\frac{1}{3}$ of inner margin, and a similar slightly sinuate line from $\frac{3}{5}$ of costa to middle of inner margin; a fuscous-reddish nearly straight line, obscurely margined anteriorly with paler, posteriorly with darker, from

costa before apex to $\frac{3}{4}$ of inner margin: cilia fuscous-reddish. Hindwings with hindmargin rounded; dull purplish-rosy, becoming light fuscous towards anal angle; second and third lines as in forewings, but only visible on dorsal half; cilia rosy, becoming fuscous-red on lower half of hindmargin.

West Australia; two specimens in the British Museum collection, from which the above diagnosis is drawn.

74. *Mon. vinaria*, Gn.

(*Oenochroma vinaria*, Gn. IX. 185, pl. VII. 2; *Balliace vetustaria*, Walk. 290.)

♂♀. 45-52 mm. Head pale brownish-ochreous, face suffused with purplish-rosy. Palpi, thorax, and abdomen light purplish-rosy. Antennæ rosy, towards apex more whitish, pectinations pale ochreous. Legs light purplish-rosy, apex of joints dark grey. Forewings elongate-triangular, apex acute, subfalcate, hindmargin suddenly sinuate beneath apex, thence bowed, oblique; pale ochreous, more or less wholly suffused with light purplish-rosy, posteriorly with a few faint cloudy grey strigulae; a nearly straight cloudy grey line from $\frac{1}{3}$ of costa to before $\frac{1}{3}$ of inner margin, preceded by an indistinct pale yellowish suffusion; a small cloudy roundish dark grey discal spot, containing a fine transverse linear transparent mark; a nearly straight cloudy pale yellowish line from costa before apex to $\frac{3}{5}$ of inner margin, anteriorly partially margined with bright ferruginous preceded suffusedly by dark grey; a hindmarginal ferruginous-orange line, becoming blackish near apex: cilia deep ferruginous-brown. Hindwings with hindmargin almost straight, slightly waved; colour and cilia as in forewings; a straight dark purplish-fuscous transverse streak from middle of costa to middle of inner margin, becoming bifurcate towards costa, on lower $\frac{2}{3}$ posteriorly ferruginous and followed by an ochreous-yellow suffusion. Forewings beneath with a large round cloudy deep purple-fuscous blotch near inner margin before anal angle.

Townsville, Queensland; Sydney, New South Wales; Mount Lofty, South Australia; four specimens. Bred by Mr. G. H.

Raynor from a larva feeding on *Hakea;* the larva is stated by Guénée, however, to feed on *Acacia* (perhaps in error), and is described as being 12-legged, with a horn on third segment and two tubercles on eleventh.

75. *Mon. digglesaria*, Gn.

(*Monoctenia digglesaria*, Gn., Ann. Soc. Fr. IV. [4 ser.], 15.)

55 mm. Wings crenulate; forewings acute, subfalcate, hind-margin strongly bowed; hindwings strongly bent in middle, forming a more prominent tooth, and another at anal angle; all wings rosy-grey; a common rosy-whitish line from apex of forewings to $\frac{2}{3}$ of inner margin of hindwings, followed by a darker shade, and preceded by small darker dots on veins; a series of darker dots representing first line; a darker median shade, hardly traceable on forewings, but straight and well-marked on hindwings. Forewings beneath with a large deep brown spot towards inner margin.

Locality given only as Australia. The above diagnosis is drawn from Guénée's description; I have seen no insect agreeing with it; it appears to indicate a good and distinct species.

76. *Mon. obtusata*, Walk.

(*Monoctenia obtusata*, Walk. 279; *M. himeroides*, ib. 279.)

♀. 54 mm. Head ochreous-whitish, face suffusedly mixed with dark fuscous-red. Palpi ochreous-whitish mixed with dark fuscous-red. Antennæ whitish. Thorax pale whitish-grey-ochreous. Abdomen fuscous-whitish sprinkled with blackish. Legs ochreous-whitish, irrorated and barred with deep fuscous-red. Forewings elongate-triangular, costa sinuate, apex produced, hindmargin rather deeply sinuate beneath apex, thence strongly bowed, very oblique; pale greyish-ochreous, sprinkled with dark fuscous; lines partially indicated by dark fuscous dots but hardly traceable except on costa, where they form slender short dark fuscous marks at $\frac{1}{3}$ and $\frac{3}{4}$, and a larger oblique cloudy fuscous mark in middle, containing a transverse-linear transparent mark in its apex, and indicating an angulated median shade: cilia fuscous-whitish, more

or less mixed and suffusedly dotted with dark fuscous, towards apex more or less wholly dark fuscous. Hindwings with hindmargin rounded, waved, slightly sinuate above anal angle; pale greyish-ochreous, sprinkled with dark fuscous, especially towards apex; a slightly curved cloudy fuscous median line, marked with a small darker spot above middle, containing a transverse linear transparent mark; cilia pale greyish-ochreous. Forewings beneath with a large round cloudy blackish-fuscous blotch towards hindmargin below middle.

Melbourne, Victoria; according to Walker also from Tasmania; one specimen.

77. *Mon. smerintharia*, Feld.

(*Monoctenia smerintharia*, Feld. pl. CXXIV. 18, 19.)

♀. 74 mm. Head and palpi deep ferruginous, crown paler. Thorax and abdomen grey irrorated with whitish. Wings formed as in *M. falernaria*, but hindmargin crenate; reddish-grey; a common obscurely pale dentate line running from apex of forewings to $\frac{2}{3}$ of inner margin of hindwings, anteriorly margined by a thick dark suffused shade, obsolete towards costa: cilia ferruginous, with darker spots on veins.

Locality uncertain; one specimen (Austr. Mus. Coll.).

78. *Mon. falernaria*, Gn.

(*Monoctenia falernaria*, Gn. IX. 184; *M. fraternaria*, ib. pl. VII. 3.)

♂♀. 56-82 mm. Head pale whitish-fuscous, face dark fuscous-purplish, suffused with whitish-ochreous towards lower part. Palpi fuscous-purplish. Antennæ ochreous-whitish, pectinations ochreous. Thorax and abdomen pale flesh-colour. Legs fuscous, femora more purplish. Forewings elongate-triangular, hindmargin sinuate beneath apex, thence strongly bowed, oblique, waved on upper portion; rosy-purplish-ochreous, densely and suffusedly irrorated with pale greyish-ochreous, and strewn with blackish-grey scales; the absence of pale irroration forms an obscurely darker triangular

blotch extending on costa from before middle to $\frac{4}{5}$, its apex resting on vein 2 beneath middle of disc, its margins obscurely subdentate, sometimes suffusedly margined with dark fuscous and then with faint cloudy paler lines continued as one to inner margin; a small cloudy dark grey spot resting on inner margin beyond middle: cilia pale greyish-ochreous, base mixed with reddish, with small dark fuscous spots on veins. Hindwings with hindmargin rounded, slightly waved; colour and cilia as in forewings; the dark grey irroration forms a cloudy sinuate fascia before middle, followed by a light greyish-ochreous fascia without dark irroration; cilia of inner margin whitish.

Bathurst (2300 feet), New South Wales; also from Victoria and Tasmania; three specimens.

79. *Mon. subustaria*, Walk.

(*Phallaria subustaria*, Walk. 283; *Hypographa privata*, ib. 286; *H. hypotaeniaria*, Gn., Ann. Soc. Fr. IV. (4 ser.) 15.)

♂. 40-42 mm. Head grey, slightly ochreous-tinged. Palpi whitish, with a few deep purple scales, towards apex grey. Antennæ grey-whitish, sometimes reddish-tinged, spotted with dark grey, pectinations ochreous. Thorax ochreous-grey, sometimes whitish posteriorly. Abdomen grey or whitish, with fine scattered purplish or black scales. Legs whitish, irrorated and ringed with blackish-crimson. Forewings elongate-triangular, apex acute, hindmargin sinuate beneath apex, thence bowed, oblique, waved; ochreous-grey, with some fine scattered black scales; costal edge sometimes white from near base to near apex; costa more or less marked with short blackish strigulæ; sometimes a small deep reddish cloudy spot on costa at $\frac{3}{5}$, with faint traces of a curved reddish or fuscous transverse shade proceeding from it; a reddish-black discal dot; a curved line of reddish-black dots from $\frac{4}{5}$ of costa to $\frac{3}{4}$ of inner margin: cilia ochreous whitish, terminal half irregularly deep reddish or blackish. Hindwings with hindmargin nearly straight; colour and cilia as in forewings, but more whitish towards base of wing; a more or less distinct straight median fascia formed by reddish irroration, sometimes

margined with blackish, narrowed towards inner margin, anterior edge sinuate, posterior dentate. Hindwings and sometimes also forewings beneath with a well-defined moderately broad median fascia formed by dark reddish-fuscous irroration, attenuated or becoming obsolete towards inner margin, posterior edge dentate, curved.

Sydney, New South Wales, in March; three specimens.

16. Hypographa, Gn.

Face with a broad rounded horny projection, more or less concealed in dense projecting scales. Tongue developed. Eyes fringed with long cilia above and beneath. Antennæ in ♂ unipectinated, apex simple. Palpi moderate, subascending, second joint with long projecting hairs beneath, terminal joint moderate, somewhat swollen towards apex. Thorax stout, long-haired, beneath densely hairy. Tarsi spinulose. Forewings with vein 6 from point with or out of 9, 10 touching 9 at a point, 11 anastomosing with 12. Hindwings with veins 6 and 7 stalked or separate, 8 anastomosing with cell from near base to beyond middle.

This is a very singular genus. In the structure of vein 8 of the hindwings it departs from the family type, and assumes a character otherwise possessed only by the *Larentiadæ*; but it is absolutely certain from a consideration of the whole of the structural characters that its place is here, and that it is in fact nearly allied to *Monoctenia*. The unipectinated antennæ, very stout thorax, spinulose tarsi, and different neuration of forewings are conclusive against its reference to the *Larentiadæ*. The ciliated eyes and horny frontal projection are curious exceptional characters, probably indicating some ancestral reversion. In superficial appearance the species approach the *Notodontidæ*. I have no doubt that the genus may be regarded as developed collaterally with *Monoctenia* from a common ancestor, which was the direct progenitor of the whole of the thick-bodied group of this family. The anastomosis of vein 8 in the hindwings has arisen quite

independently of the similar structure in the *Larentiadæ*, and no affinity is implied by it, as the preponderance of other character shows; indeed, it might perhaps have been expected to arise independently more often, in which case the distinction of the families could not have been maintained.

1.	Hindwings white on basal half................	2.
	Hindwings not white on basal half...........	3.
2.	Forewings with a blackish mark on costa at $\frac{1}{3}$	80. *hiracopis.*
	Forewings without a blackish mark on costa at $\frac{1}{3}$..	81. *serpentaria.*
3.	Forewings with a straight dark fuscous fascia beyond middle..........................	83. *atmoscia.*
	Forewings without a straight dark fuscous fascia beyond middle..........................	82. *phlegetonaria.*

80. *Hyp. hiracopis*, n.sp.

♂. 38 mm. Head whitish, somewhat mixed with dark fuscous, face suffused with dark fuscous. Palpi whitish mixed with blackish. Antennæ whitish sprinkled with grey, pectinations ochreous. Thorax whitish mixed with fuscous hairs. Abdomen whitish irrorated with dark fuscous, two basal segments ochreous. Legs dark fuscous, partially irrorated with white. Forewings very elongate-triangular, costa subconcave, hindmargin rounded, strongly dentate; fuscous, densely and suffusedly strewn throughout with whitish; costa shortly strigulated with dark fuscous; veins marked with fine dark fuscous lines; a short oblique blackish mark from costa at $\frac{1}{3}$, whence proceeds a very fine partially obsolete very deeply dentate dark fuscous line to inner margin before middle; an indistinct fuscous median shade from $\frac{3}{5}$ of costa to $\frac{3}{5}$ of inner margin, darker and more distinct in disc, strongly curved outwards on upper half; a very fine very deeply dentate dark fuscous line from $\frac{3}{4}$ of costa to $\frac{2}{3}$ of inner margin; a rather broad straight very ill-defined fuscous shade from apex to inner margin before anal angle; a fine dark fuscous hindmarginal line: cilia fuscous irrorated with whitish, tips whitish. Hindwings

with hindmargin rounded, dentate; 6 and 7 stalked; white, thinly scaled, posteriorly suffused with pale fuscous; veins on posterior half rather dark fuscous; a faint subdentate fine fuscous line at $\frac{3}{4}$; a fine dark fuscous hindmarginal line; cilia fuscous, suffusedly barred with whitish, tips whitish.

South Australia; one specimen. It is possible that this might be the other sex of the following species, but as Guénée's description, though incomplete, differs from it in very many details, I have not felt justified in uniting them.

81. *Hyp. serpentaria*, Gn.

(*Hypographa serpentaria*, Gn., Ann. Soc. Fr. IV. [4 ser.] 15.)

♀. Rather smaller than *H. phlegetonaria*, wings similarly formed, deeply dentate; forewings ashy-grey, wholly occupied by sinuous and contorted black lines, anteriorly margined with lighter grey; ordinary lines perceptible but entangled; an annular reniform discal spot; second line forming strong unequal teeth; an interrupted black hindmarginal line. Hindwings white from base to end of cell, thence dark grey crossed by three sinuate-dentate blackish lines, margined with white on inner margin, not reaching costa and anal angle, which are white. Underside of hindwings white with a dark fuscous central lunule and hindmarginal band.

Locality given as Australia only. The above description is modified from that of Guénée, who states his type to be in poor condition.

82. *Hyp. phlegetonaria*, Gn.

(*Hypographa phlegetonaria*, Gn. IX, 190, pl. XIX. 2.)

♂♀. 36 mm. Wings strongly dentate, blackish-grey, costa and base of cilia partly white; forewings with a blackish discal spot and four indistinct cloudy denticulate lines, most distinct on costa; first isolated, other three parallel and at equal distances; hindwings with three similar lines, first median, nearly straight, other two somewhat curved. Abdomen fuscous, ante-apical segment white at base, anal segment wholly whitish.

Tasmania. I have seen but unfortunately neglected to describe specimens of this species; the above diagnosis is taken from Guénée's description and figure, of which the former is very incomplete and partially unintelligible; I have endeavoured to interpret it by the aid of the figure, which is pretty good. It is an easily recognisable species.

83. *Hyp. atmoscia*, n.sp.

♀. 33 mm. Head, palpi, and thorax dark fuscous densely irrorated with whitish. Antennæ fuscous. Abdomen whitish-fuscous sprinkled with dark fuscous. Legs dark fuscous. Forewings rather elongate-triangular, costa slightly sinuate, hindmargin rounded, crenate; fuscous, irrorated with whitish; a somewhat curved fine black line from beyond $\frac{1}{3}$ of costa to before $\frac{1}{3}$ of inner margin, indented above middle; a straight narrow dark fuscous fascia from $\frac{3}{5}$ of costa to $\frac{3}{5}$ of inner margin, anterior edge blackish, well-marked, posterior edge gradually suffused; a very fine subdentate blackish line from $\frac{4}{5}$ of costa to $\frac{3}{4}$ of inner margin, rather deeply sinuate inwards above middle and less deeply on lower half; some fine scattered blackish scales beyond this: cilia fuscous irrorated with whitish (imperfect). Hindwings with hindmargin slightly rounded, crenate; 6 and 7 separate; whitish-fuscous, with scattered dark fuscous scales; a straight cloudy fuscous central fascia, anterior edge tolerably distinct, posterior suffused; cilia fuscous mixed with whitish (imperfect).

Perth, West Australia; in November, one specimen.

Appendix.

The following species, referred by Guénée and Walker to the immediate neighbourhood of those included in this family are either wrongly so referred, or unidentifiable.

84. *Panagra fictiliaria*, Gn. X. 129. A clay-yellow species, described from ♀ only; I cannot identify it at all, but imagine it is probably wrongly placed here.

85. *Panagra nullata*, Gn. X. 130. A unicolorous yellowish-grey species, which appears unidentifiable, and is only conjecturally supposed to be Australian; it may be safely neglected.

86. *Panagra sparsularia*, Gn. X. 131, pl. XII. 4. Wrongly placed here; belongs to the *Boarmiadae*.

87. *Panagra diffusaria*, Gn. X. 132. An obscure unidentified species, perhaps referable to the *Larentiadae*.

88. *Panagra subvelaria*, Walk. 1000. No type seen; a *Taxeotis*, but unidentifiable.

89. *Panagra aviata*, Walk. 1001. Not fully identified, but appears to belong to *Boarmiadae*.

90. *Panagra ferritinctaria*, Walk. 1002. Belongs to *Boarmiadae*.

91. *Panagra approximata*, Walk. 1002; *P. intercalata*, ib. 1012. Belongs to *Larentiadae*.

92. *Panagra extentata*, Walk. 1012. Belongs to *Noctuina*.

93. *Panagra inostentata*, Walk. 1012. Belongs to *Noctuina*.

Index of Species of *Monocteniadae*.

REVISION OF THE GENUS *HETERONYX*, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem. Linn. Soc. N.S.W.

Part V.

APPENDIX.

What I desire to supply in this Appendix is three-fold,—viz., notes on such previously described species of *Heteronyx* as I have failed to identify among the specimens to which I have had access,—amendments of ambiguities, &c., in the body of my work now completed,—and descriptions of species that have come into my hands subsequently to the publication of the parts of the "Revision" referring to the several "Sections" to which they belong.

As regards the previously described species there are a certain number that I have been compelled to disregard altogether;—viz., those in the published descriptions of which there is no account of the antennal structure, and of which at the same time I could not procure authentic types. To have applied the names of such species to any particular specimens could only have been guess work. They are the following:—*infuscatus*, Macl., *pallidulus*, Macl., *parvulus*, Macl., *pubescens*, Macl., *ruficollis*, Macl., *subglaber*, Macl., *substriatus*, Macl., *subvittatus*, Macl., *transversicollis*, Macl. One of these (*pubescens*) is a nom. præocc. The rest occur in localities distant from those in which any of my new species were taken, and (as most species of *Heteronyx*

seem to have a very limited area of distribution) this points to the probability of their all being distinct from any I have described.

After deducting the above 9 species as being (to me at least) incapable of identification, and allowing for several cases of synonymy, there remain 36 descriptions known to me as anterior to my work, all of which I believe to represent good species. Of these I have succeeded in identifying only 13 with insects before me, and these will be found referred to in their places in my work.

Of the remaining 23, 9 are from Tasmania and are very likely to be confined to that island (whence I have described only one new species) and 2 are from Raffles Bay, another isolated locality likely to produce species different from any I have seen. I have nothing before me agreeing satisfactorily with the description of any of them.

There then remain 12 species which (although I have been unable to identify them as represented among those before me) might appear likely on *a priori* grounds to be present there. Concerning 8 of these the descriptions supply sufficient information to enable me to feel fairly confident that I have not seen them; they are *holomelænus*, Blanch., *laticeps*, Burm., *pellucidus*, Burm., *planatus*, Burm., *proximus*, Burm., *rubriceps*, Blanch., *rufomarginatus*, Blanch., *unguiculatus*, Burm.

The remaining 4 (viz., *laticollis*, Blanch., *nigritus*, Blanch., *pilosellus*, Blanch., *oblongus*, Blanch.), are quite insufficiently described by their author, and it is possible that I have redescribed some of them.

The most convenient method, in adding a last word here and there to correct faults and furnish descriptions of species that have come into my hands subsequently to my having dealt with the aggregates to which they belong, will be to divide the species into groups (following the same classification as previously), and discuss those groups separately. I shall take them thus:—

[Section I.]—Species with the labrum entirely and considerably below the plane of the clypeus, the clypeus itself being evenly reflexed all round its free margin, and at most feebly emarginate.

A. Antennæ 8-jointed.. .... Group I.

B. Antennæ 9-jointed.............. Group II.

[Section II.]—Species having the labrum much exposed to view from above (through profound emargination of the clypeus or other causes) but not rising above the level of the clypeus...... Group III.

[Section III.]—Species having the clypeus more or less overtopped by the labrum.

A. Antennæ 8-jointed.

a. Claws bifid .... Group IV.

b. Claws appendiculate........ Group V.

B. Antennæ 9-jointed.

a. Claws bifid........ .... Group VI.

b. Claws appendiculate .... Group VII.

GROUP I.

Here I have to remark that in the "Revision" (Proc. L.S. N.S.W. 1888, pp. 1332-40) I omitted to state categorically that the anterior tibiæ of all the species (except *brevicollis*, Blackb., and *rufopiceus*, Macl.) known to me as belonging to this group have three well-defined teeth externally.

I have also to describe two new species recently received by me.

H. BOVILLI, sp.nov.

Minus elongatus; postice sat dilatatus; ferrugineus; pilis brevibus adpressis sparsim vestitus; crasse fortiter sat sparsim (clypeo minus sparsim) punctulatus; labro clypeum haud superanti; antennis 8-articulatis; coxis posticis metasterno paullo brevioribus; unguiculis bifidis. [Long. 3-4, lat. $1\frac{3}{5}$-2 lines.

The labrum is a little more prominent and upturned than in typical species of this section. The clypeus forms an almost perfectly even and continuous surface with the rest of the head, the clypeal suture being scarcely visible; its free margins are moderately reflexed and its front is feebly concave in the middle. The prothorax is about $\frac{3}{4}$ again as wide as long, its base being slightly more than $\frac{1}{2}$ again as wide as its front, which is moderately concave with moderately prominent and sharp angles; the sides are feebly arched (almost parallel behind the middle), the hind angles well defined, the base is gently bisinuate and consequently but little lobed hindward in the middle. The elytra are scarcely wrinkled transversely, their lateral fringe being normal, their apical membrane very well-defined. The whole upper surface is strongly and coarsely, but not closely, punctured (the clypeus more closely, the pygidium more feebly, than the rest); the punctures so spaced that about 10 or 12 of average distance would occupy the middle line down the prothorax. The hind coxæ are a little shorter than the metasternum and decidedly longer than the 2nd ventral segment. The puncturation of the under surface is strong and somewhat even, but in all parts becoming less close towards the middle. The ventral series consist of fine hairs and are but little conspicuous. The lævigate antero-internal space on the hind coxæ is but feebly defined. The hind femora are moderately wider than the intermediate, their inner apical angle strongly defined. The three external teeth of the front tibiæ are very strong and sharp, the uppermost being about half the size of the 2nd. The hind claws are minutely bifid, the produced piece of the basal portion being much thicker than, and about as long as, the apical piece.

In the tabulation of the 1st section of *Heteronyx* (Proc. L.S. N.S.W. 1888, pp. 1328, &c.) this species would fall under "C." (line 3, p. 1329), its companions under that letter being *fulvo-hirtus* and *badius*; the hind claws of the former of these are appendiculate (the produced apex of the basal piece being very much smaller than the apical piece), while the latter is an infinitely more closely punctulate insect than *H. Bovilli.*

N. Territory of S. Australia; taken by Dr. Bovill.

H. ADVENA, sp.nov.

Minus elongatus; postice vix dilatatus; ferrugineus, antennarum clava testacea; pilis minus brevibus adpressis minus sparsim vestitus; sat fortiter (postice gradatim minus fortiter) punctulatus; labro clypeum haud superanti; antennis 8-articulatis; coxis posticis metasterno vix brevioribus; unguiculis bifidis; segmentis ventralibus apicalibus vix perspicue punctulatis. [Long. $3\frac{3}{5}$, lat. $1\frac{4}{5}$ lines.

The description of the head of *H. Bovilli* will apply to this species, subject to the remark that the clypeus is not at all emarginate in front. The description of the prothorax (disregarding puncturation) will apply moreover, except that in this species the sides are a little more arched and the hind angles are quite rounded off. The transverse wrinkling of the elytra is little noticeable, their lateral fringe normal, their apical membrane obscure. The puncturation of the head is coarse, strong, and rather close,—that of the prothorax and elytra successively feebler, that of the pygidium quite obsolete; the punctures on the prothorax are spaced so that about 14 or 15 of average distance apart would run in a line down the middle. There is some indication in this species of a sutural stria and the suture is slightly elevated, while in *H. Bovilli* the suture is non-striate and flat. The proportions of the various parts on the underside are almost as described above (vide *H. Bovilli*), but the hind coxæ are a little longer. The puncturation of the metasternum

and hind coxæ is a little feebler than in *H. Bovilli*; the whole undersurface is minutely coriaceous and therefore less nitid, the ventral segments are almost without a trace of distinct punctuation, the ventral series are stout and conspicuous, the antero-internal tooth of the hind femora is very feeble, the uppermost tooth on the front tibiæ is much less than half the size of the 2nd, and the hind claws are bifid less minutely, the produced apex of the basal piece being distinctly smaller than the apical piece.

This species can be distinguished from all the others (having 8-jointed antennæ) of the 1st section by its impunctulate ventral segments. If its stout ventral series should place it in the group A (Proc. L.S.N.S.W. 1888, p. 1328) it would fall under FF (same page) with *frontalis*; among the species of BB (p. 1329) it would have to follow *badius*,—thus,

"DDD. Clypeus not at all emarginate in
front .... *advena*, Blackb."

Locality uncertain; but I believe it to be Central Australia.

H. LILLIPUTANUS, sp.nov.

Minus elongatus; postice leviter dilatatus; rufo-piceus, antennis testaceis; pilis sat elongatis minus dense vestitus; crasse sub-rugulose punctulatus; labro clypeum haud superanti; antennis 8-articulatis; coxis posticis metasterno parum brevioribus; unguiculis appendiculatis. [Long. 2 (vix), lat. 1 line.

The clypeus is evenly reflexed all round and its free outline forms a continuous even curve (the labrum being entirely below it); its plane is not evenly continuous with that of the rest of the head. The prothorax is half again as wide as long and its base (which is bisinuate and rather strongly lobed hindward in the middle) is more than half again as wide as the front which is moderately emarginate with moderately produced and sharp angles; the sides are rather strongly rounded, the hind angles quite

rounded off. The elytra are devoid of striation, their transverse wrinkling is very conspicuous, their lateral fringe normal, their apical membrane obsolete. The puncturation of the whole upper surface is coarse and rough. The puncturation of the undersurface is strong; on the metasternum it is moderately close but becomes less so hindward. The hind coxæ are not much shorter than the metasternum and are very much longer than the 2nd ventral segment. The ventral series consist of long fine hairs and are moderately conspicuous. The hind femora are considerably wider than the intermediate with their inner apical angle very little developed. The hind claws are appendiculate, the basal piece about twice as large as the apical with its inner apex little produced. The front tibiæ are much compressed and dilated, with three large obtuse teeth on their external margin, of which the uppermost is about half as large as the 2nd.

This minute species seems to be allied to *H. hirtuosus*, Blackb., from which, however, it differs by many structural characters. In the tabulation it would stand side by side with *H. spretus*, Blackb., from which its small size will at once distinguish it.

A single example in my own collection; taken in the Adelaide district.

The following previously described species belonging (with more or less certainty) to this group (*i.e.*, having the labrum entirely below the clypeus and 8-jointed antennæ) I have not been able to identify,—viz., *rotundiceps*, Blanch., *spadiceus*, Burm., and *unguiculatus*, Burm. Of these *rotundiceps* is said to be iridescent (differing thereby from all known to me in the group) and to occur in "Eastern New Holland;" its size is not specified. *H. spadiceus* is from Swan River (I have not seen any species of the group from Western Australia), its length is 4 lines, and it is described as entirely glabrous; the description of the relation of clypeus and labrum is vague,—the latter being merely said to "protrude in front of" the former,—but it would probably fall in this group; I do not think anything I have seen can be identical with it. *H. unguiculatus* is said to be from "New Holland,"

without more definite indication of locality; its labrum is said to rise to the level of the clypeus, but nevertheless the clypeus to be scarcely even sinuous in front; it appears to be a small species (long. 3-3½ lines), of a brownish-testaceous colour, with close fine puncturation, bidentate front tibiæ and strongly bifid claws.

GROUP II.

In the tabulation of the species (Proc. L.S.N.S.W. 1888, pp. 1329-31) I find a slight ambiguity of expression;—certain species being divided as having "E—the hind coxæ considerably (EE scarcely, if at all) shorter than the metasternum on the external margin." *H. solidus* (under the former initial) is separated from *H. Beltanæ* and *satelles* as having the hind coxæ "very little" shorter than the metasternum. The difference here indicated very satisfactorily separates the species, and the "very little" of *solidus* is quite distinct from the "scarcely, if at all" of *æqualis* and *holosericeus*,—but as it is undoubtedly obscurely worded in my tabulation I suggest the substitution (p. 1330, lines 26-30) of the following,—

L. Hind angles of prothorax (viewed from above) appear well-defined [size more than 4 lines] .... *solidus*, Blackb.

LL. Hind angles of prothorax (from all points of view) appear quite rounded off [size less than 4 lines] ....

Neither am I quite satisfied with my treatment in this group of the claw structure which (since the issue of Part I. of the "Revision") I have found to be more useful for distinction of species than I at first thought. I think it well therefore now to supply the following more detailed and accurate information and to base it upon the *hind* claws. The claws more particularly referred to in the tabulation in Part I. were those of the *front* legs,—but as

these generally vary with the sex they furnish less reliable specific characters.

A. Hind claws strongly "bifid,"—*i.e.*, having the apex of the basal piece produced in a conspicuous process more than half as large as the whole of the apical piece—*breviceps, rugosipennis, solidus, Beltanæ, corpulentus, holosericeus, piceoniger.*

B. Hind claws bifid (as above), but only minutely and at the apex —*variegatus* and *Darlingensis.*

C. Hind claws "appendiculate,"—*i.e.*, having at the inner apex of the basal piece a free projection less than half as large as the apical piece.

a. The appendiculation minute and close to the apex of the claw—*æqualis, testaceus, satelles.*

b. The apical piece fully as long as the basal piece—*Froggatti.*

c. The appendiculation normal—*i.e.*, the basal piece a little longer than the apical and with its apical process more or less feeble—*piceus, horridus, gracilipes, Victoris, occidentalis, pubescens, Randalli.*

H. PICEONIGER, Macl.

Since the publication of Part I. of the "Revision" I have received from Dr. Bovill examples of a *Heteronyx* which agrees very well with the description of *H. piceoniger*, Macl. Mr. Froggatt of Sydney has done me the favour of comparing a specimen with the type and considers it the same species. In my tabulation (Proc. L.S.N.S.W. 1888, pp. 1328-31) it would fall side by side with *H. corpulentus*,* (HH. p. 1331) from which it may be at once distinguished by the exceptionally coarse and sparse puncturation of its head.

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* It should be noted however that the erect hairs on the elytra are scarcely to be called "long" (*vide* "GG." line 14, p. 1331) in *H. piceoniger.*

H. PUBESCENS, Er.

I have before me an example taken in Tasmania by Mr. T. G. Sloane, which I cannot doubt is this species, as it agrees perfectly with Erichson's description. M. Lacordaire (Gen. Col. III., p. 232, note) states that *H. pubescens* has simple claws, on the strength of which I expressed the opinion (Proc. L.S.N.S.W. 1888, p. 1328), that it could not be a true *Heteronyx;* but with the present specimen before me (which has distinctly appendiculate claws, the basal piece about twice as large as the apical), I am compelled to conclude that Lacordaire was mistaken. In Masters' Catalogue the species is assigned to *Caulobius.* In my tabulation *H. pubescens* would fall side by side with *H. gracilipes*, Blackb., from which it differs *inter alia* by the very much more obtuse teeth of its front tibiæ, the uppermost of them being subobsolete.

H. RANDALLI, sp.nov.

Minus elongatus; postice vix dilatatus; ferrugineus; pilis depressis minus dense vestitus; subtilius minus crebre (capite crasse rugulose) punctulatus; labro clypeum haud superanti; antennis 9-articulatis; coxis posticis metasterno sat brevioribus; unguiculis appendiculatis. [Long. $3\frac{2}{5}$ (vix), lat. $1\frac{2}{3}$ lines.

The clypeus is evenly reflexed all round and its free outline forms a continuous curve scarcely flattened or subsinuate in front (the labrum being entirely below); its plane and puncturation are almost perfectly continuous with the rest of the head, from which it is separated by a very obscure suture. The prothorax is about $\frac{3}{4}$ again as wide as long, its base (which is scarcely bisinuate but considerably lobed hindward all across) something less than $\frac{3}{4}$ again as wide as its front which is only moderately emarginate with angles not very sharp nor strongly produced; the sides are moderately rounded and the hind angles are quite rounded off. The elytra have scarcely a trace of striation even along the suture, their transverse wrinkling is feeble, their lateral fringe is normal,

their apical membrane well defined. The puncturation (except on the head) is neither strong nor close, a little stronger and less close on the prothorax than on the elytra; on the prothorax the punctures are spaced so that about 17 of average distance apart would lie down the middle line. On the underside the hind coxæ are much shorter than the metasternum but not very much longer than the 2nd ventral segment; the metasternum is rather finely and sparingly punctured, the hind coxæ more coarsely, but with a well defined lævigate antero-internal space. The ventral segments are rather coarsely punctured, the ventral series consisting of fine hairs and being inconspicuous. The hind femora are moderately wider than the intermediate, their inner apical angle feeble. The hind claws are appendiculate, the basal piece not much longer than the apical and having its inner apical angle fairly defined and sharp. The front tibiæ have three rather blunt external teeth, the uppermost being especially blunt and scarcely half as long as the 2nd.

In the tabulation (Proc. L.S. N.S.W. 1888) this species would fall under "D" (at bottom of p. 1329); from *piceus* and *Froggatti* it differs *inter alia* in the free outline of the clypeus not forming an even curve; from *occidentalis* in the same being feebly sinuate, not strongly emarginate.

Barrow's Creek, N. Terr.; taken by Mr. W. D. Randall.

H. DECEPTOR, sp.nov.

Minus elongatus; postice leviter dilatatus; minus nitidus; piceo-niger, antennis palpis tarsisque piceo-ferrugineis; pilis elongatis suberectis confuse vestitus; crebre, sat rugulose, minus fortiter, punctulatus; labro clypeum haud superanti; antennis 9-articulatis; coxis posticis metasterno paullo brevioribus; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali vix longiori. [Long. $4\frac{3}{5}$, lat. $2\frac{2}{5}$ lines.

This species (apart from its shorter and wider form, the greater distinctness of the clypeal suture, the prothorax only about half

again as wide as long and with slightly more rounded sides, 9-jointed antennæ, the long scattered hairs rather thinly—increasingly so hindward—clothing its surface; the absence of a conspicuous red membranous border to the elytra, the much darker colour of the antennæ and palpi, the fine hairs on the legs and underside and which form the ventral series, and the shorter and more slender tarsi) scarcely differs from *H. torvus*, Blackb., the description of which (subject to the foregoing remarks) may be read as applying to it. In one example before me I find a faint indication of striæ on the elytra, in the other none at all; *H. torvus* varies in this respect. It should be noted, however, that I have not seen a female example of this insect. In the tabulation (Proc. L.S. N.S.W. 1888, pp. 1328, &c.), this species would fall side by side with *piceus*, Blanch., from which *inter alia* the long hairs over its upper surface may be taken as a distinction.

Victoria; taken by Mr. T. G. Sloane in Gippsland.

H. PICEUS, Blanch.

I have received from Mr. T. G. Sloane a specimen of *Heteronyx* taken on the Blue Mountains which, with much doubt, I am inclined to regard as a very peculiar example of this insect. Its very diminutive size (long. $4\frac{2}{5}$ lines) is accompanied by a shortening of the hind coxæ, those organs being (not much, but certainly a little) smaller in proportion to the metasternum than in specimens of *piceus* from other localities. The appendiculation of the claws moreover seems to be a little nearer the apex in this example than in typical *piceus*. The resemblance to *piceus* however is too close to justify me in giving a new name on the inspection of a single example.

H. VIATOR, sp.nov.

Minus elongatus; postice leviter dilatatus; rufo-ferrugineus, antennis palpisque testaceis; pilis adpressis sat brevibus sat sparsim vestitus; sat fortiter minus crebre (capite crebre rugulose),

punctulatus; labro clypeum haud superanti; antennis 9-articulatis; coxis posticis metasterno sat brevioribus; unguiculis appendiculatis; unguiculorum posticorum parte basali apicali fere duplo longiori. [Long. $4\frac{2}{5}$, lat. $2\frac{1}{5}$ lines.

The clypeus is evenly reflexed all round, the curve of its free outline however being a good deal flattened or truncate in front (the labrum being entirely below it); its plane is moderately distinct from that of the rest of the head with a fairly marked arched suture. The whole head is coarsely and very closely (almost confluently) punctured and bears some longish erect hairs. The prothorax is slightly more than half again as wide as long, its base (which is bisinuate and moderately lobed in the middle) being about half again as wide as its front which is rather strongly concave, with sharp well-produced angles; the sides are moderately arched (at their greatest divergence a little behind the middle), and the hind angles are much rounded off,—scarcely defined from any point of view. The transverse wrinkling of the elytra is rather conspicuous, their lateral fringe is normal, their apical membrane obsolete. The hind coxæ are considerably shorter than the metasternum but only moderately longer than the 2nd ventral segment. The whole undersurface is punctured very similarly to the elytra, the hind coxæ however having a large lævigate antero-internal space. The ventral series consist of fine hairs. The hind femora are moderately wider than the intermediate and have their inner apical angle but feebly defined. The hind claws are appendiculate, their basal piece being about twice as long as the apical. The three teeth on the front tibiæ are fairly strong and sharp, the uppermost being about half as large as the 2nd.

The elytra are punctured a little less closely, and more strongly, than those of *H. gracilipes*. The puncturation of the prothorax (being slightly stronger and sparser than of the elytra) all the more differs from that of *H. gracilipes*. In the tabulation (Proc. L.S.N.S.W. 1888, pp. 1328, &c.) this species would fall side by side with *H. Victoris* to which it is extremely close, but the differently shaped front of clypeus, prothorax more concave in

front and slightly more transverse, decidedly coarser puncturation of ventral segments, &c., together with totally different colour seem to point to specific distinctness. The punctures on the prothorax are spaced so that about 17 of average distance apart would range down the middle line.

Edithburgh; taken by Mr. McDougall.

The following species I have been unable to identify; some (and perhaps all) of them belong to this group.

H. laticeps, Burm. A large species (long. 6 lines) said to be of a chestnut colour and to have the apical membrane of its elytra very conspicuous. The description of its puncturation is very obscure, and there is no indication of locality beyond "Australia."

H. pilosellus, Blanch. The description of this species is identical with that of *H. piceus* in respect of all characters of any real value for identification. It is therefore quite likely that the species I have treated as *H. piceus* may be this. Both are said to occur in "Eastern New Holland."

H. planatus, Burm. Said to occur at Adelaide and to be remarkable for its depressed form (long. 4 lines). I know no species corresponding to this description.

H. præcox, Er., *H. tempestivus*, Er. Both from Tasmania. According to Erichson both have 9-jointed antennæ, but Blanchard makes the former the type of a new genus with 8-jointed antennæ and peculiarly shaped labrum, while Lacordaire states that the latter has antennæ of only 8 joints. Under these circumstances it is evident that no species (at any rate unless taken in Tasmania) could be reasonably made to bear these names without having been compared with the original type.

GROUP III.

This group (identical with my Section II) consists of species that cannot rightly be placed in either of the other sections. The relation *inter se* of the labrum and clypeus is usually as follows:—

the labrum is turned upward as in Section III., but not so strongly that its summit surpasses the level of the clypeus; the clypeus is *strongly* emarginate in the middle (its reflexed margin being carried evenly all round the edge of the emargination) and this emargination opens a gap through which the labrum is very conspicuously discernible; or the clypeus is more nearly truncate in front, the species having it so being distinguishable from nearly all of Section III. by their clypeal outline not having from any point of view a "trilobed" appearance.

As the number of species belonging to this group described in my former paper was small, and I have a good many to add now, I think it will be convenient to give a new tabulation, as follows:—

A. Antennæ 8-jointed .... *rubescens*, Blanch.

AA. Antennæ 9-jointed......................

*B. Front of clypeus more or less truncate or lightly concave..................

C. Surface of the elytra normally pubescent.......................

D. Hind coxæ very much shorter than metasternum,—their external hind angles quite rounded off...................

E. Clypeus punctured very much more closely than the hind part of the head..........

F. Prothorax considerably wider at base than in front...................... *granum*, Burm.

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* *H*, *granum*, Burm., verges towards "BB" in the form of its clypeus, and *H. obesus* verges towards "B," the clypeus of the latter being scarcely *very much* more deeply excised in the middle than that of *H. granum*. There can be no mistake as to which of these groups any of the other 9 species fall into.

FF. Prothorax scarcely wider at base than in front *diversiceps*, Blackb.

EE. Head punctured uniformly or nearly so.............. *æqualiceps*, Blackb.

DD. Hind coxæ not much shorter than metasternum,—their external hind angles sharply defined... .... *quadraticollis*, Blackb.

CC. Surface of elytra sparsely set with very long erect hairs rising from shining granules *setifer*, Blackb.

BB. Middle of free clypeal outline deeply, and more or less narrowly, excised..............

C. Head punctured.....................

D. Surface of elytra not set with erect setæ.....................

E Summit of labrum considerably below level of clypeus

F. Prothorax not much more than half again as wide as long.................... *simulator*, Blackb.

FF. Prothorax about $\frac{3}{4}$ again as wide as long....... *fissiceps*, Blackb.

EE. Summit of labrum scarcely below level of clypeus

F. Puncturation of upper surface fine and very close................. .... *excisus*, Blackb.

FF. Puncturation of upper surface coarse and sparse.................. *obesus*, Burm.

DD. Surface of elytra set with erect setæ.................. *pygidialis*, Blackb.

CC. Head lævigate..................... *læviceps*, Blackb.

H. SETIFER, sp.nov.

Sat elongatus; minus convexus; postice vix dilatatus; sat nitidus; ferrugineus, antennis, palpisque testaceis; elytris setis longis fulvis erectis (haud pilis brevibus adpressis intermixtis) sparsim vestitus; capite (clypeo crebre rugulose excepto) subtiliter leviter minus crebre, prothorace dupliciter (subtiliter et vix subtiliter) leviter sat sparsim, elytris squamose vix crebre sat crasse nec fortiter, pygidio leviter sat sparsim, punctulatis; labro clypeum haud superanti (hoc antice concavo); antennis 9-articulatis; unguiculis appendiculatis, unguiculorum posticorum parte basali apicali vix longiori; coxis posticis metasterno haud brevioribus. [Long. $5\frac{2}{5}$, lat. $2\frac{1}{5}$ lines.

The relation of labrum and clypeus *inter se* is such in this species as to render its position in my arrangement very doubtful; the summit of the labrum is scarcely below the level of the clypeus and this latter (though arcuately emarginate in front and with a continuous reflexed margin) has not the deep more or less triangular excision in the middle that is usual in the species of Section II. It is distinguished, however, from nearly all the species of Section III., by the relation of labrum and clypeus being such that from no point of view has the free outline of the head the very slightest "trilobed" appearance,—the middle lobe (*i.e.*, the labrum) from the most favourable point of view appearing to have a concave outline. The clypeus is closely and finely rugulose in strong contrast to the rest of the head and the prothorax, which are finely, smoothly, faintly and not closely punctulate. The prothorax is a little more than half again as wide as long, the base (which is bisinuate and moderately lobed hindward in the middle) not quite half again as wide as the front which is rather strongly concave with sharp fairly well-produced angles; the sides are very little arched, the hind angles much rounded off.

The elytra are punctured considerably more strongly than the prothorax; their transverse wrinkling is fairly defined, their apical membrane obsolete; the setæ are placed more or less in rows on their surface and spring from minute pustules. The hind coxæ are very fully as long as the metasternum. On the under-surface the metasternum is punctured fairly strongly and not very closely, the hind coxæ more feebly and more closely (with a distinct lævigate antero-internal space) the hind body very finely. The ventral series spring from conspicuous pustules and consist of stoutish hairs. The hind femora are much wider than the intermediate and have their inner apical angle scarcely defined. The basal joint of the hind tarsi is much longer than the 2nd joint (a very unusual character). The 3 external teeth of the front tibiæ are moderately strong but not very sharp.

Extremely like *H. granulifer*, Blackb., but differing from it widely in respect of structural characters.

Adelaide district.

H. DIVERSICEPS, sp.nov.

Sat elongatus; postice minus dilatatus; sat nitidus; ferrugineus, pilis sat longis suberectis crebrius vestitus; clypeo crebre fortiter rugulose, capite postice sparsius minus rugulose, prothorace subfortiter sat crebre, elytris crebrius minus fortiter squamose, pygidio ut prothorax, punctulatis; labro clypei superficiem haud admodum attingenti, nihilo minus superne conspicuo; antennis 9-articulatis; unguiculis bifidis. [Long. 3, lat. $1\frac{2}{5}$ lines.

This is another species that seems a little to hover been Sections II. and III., the labrum and clypeus being very similar to those of *H. setifer* except that the latter is scarcely at all emarginate in front. Like *H. setifer* it shows no indication (from any point of view) of the outline of the head being trilobed. The clypeus is very distinct from the rest of the head, from which it is separated by an almost straight suture, its front being distinctly reflexed and scarcely emarginate, the labrum projecting forward considerable in front of it, but not quite rising to its level. The

prothorax is rather more than half again as wide as long, its base not much wider than its front, which is moderately concave (slightly bisinuate), with but little produced and not very sharp angles; the sides are gently arched, the hind angles much rounded off, the base being gently convex all across. The elytra are punctured more closely than, but about as strongly as, the prothorax; their lateral fringe is normal, their apical membrane scarcely defined. The hind coxæ do not exceed the 2nd ventral segment in length. The puncturation of the metasternum and hind coxæ is strong and fairly close on the sides, becoming more sparse towards the middle, the latter having an elongate lævigate antero-internal space. The ventral segments are punctured rather strongly and by no means closely all across; the ventral series are moderately conspicuous and consist of long fine hairs. The hind femora are very little wider than the intermediate, their inner apical angle but little marked. The three external teeth of the front tibiæ are stout and blunt, the uppermost very much less than half the size of the middle one. The apical piece of the hind claws is less than $\frac{1}{3}$ the size of the basal piece, and about twice as large as the produced apex of the latter.

Perhaps near *H. tempestivus*, Er., or *præcox*, Er., but (apart from the difficulty of the antennæ of those species having been subsequently said to be only 8-jointed) Erichson says that the puncturation of the underside is more or less obsolete, whereas in this insect it is particularly strong and well-defined.

South Tasmania; taken by Mr. T. G. Sloane.

H. GRANUM, Burm.

Sir William Macleay has sent me under this name a S. Australian specimen of an insect that I have several times met with in the Adelaide district. The examples I have seen vary in size (long. 2-3 lines). I think it not unlikely to be correctly named, although Burmeister's description is not minute enough to allow of any certainty. The objection to the identification is principally that Burmeister says "labro altissimo," from which it

might be inferred that the labrum strongly overtops the clypeus, whereas in this species it scarcely reaches the level of the upper surface of the same. As, however, the labrum stands out strongly in a forward direction, and its upward directed part is very perpendicular, it has the appearance on a casual glance of being very high.

This insect is so extremely like the preceding (*H. diversiceps*) that the description of that species may be taken to apply to it, with the following modifications:—the clypeus, instead of being evenly truncate in front with a well-defined continuous reflexed margin, has the front edge turned up perpendicularly,—so that if the erect face of the labrum be looked at from in front, the front of the clypeus seems to stand up behind it as another similar erect surface; the prothorax is considerably narrowed forward and is much more strongly lobed hindward in the middle, its puncturation being scarcely different from that of the elytra; the three external teeth of the front tibiæ are stronger and sharper.

H. ÆQUALICEPS, sp.nov.

Parum elongatus; postice minus dilatatus; sat nitidus; ferrugineus, pilis sat brevibus adpressis vestitus; capite toto sat æqualiter sat fortiter sat crebre, prothorace elytrisque minus fortiter, punctulatis; labro sat fortiter porrecto clypei superficiem haud attingenti; antennis 9-articulatis; unguiculis bifidis.

[Long. $2\frac{3}{3}$-3, lat. $1\frac{2}{3}$- (vix) $1\frac{1}{2}$ lines.

This species is so evidently a close ally of the preceding two that it would seem hardly possible to place it in another section, but it is undeniable that the labrum is not very much more prominent than in some species of Section I. (e.g., *Bovilli*). It (*i.e.*, the labrum) is not protruded forward so much as in the preceding two species, neither does it rise so nearly to the level of the clypeus,—nevertheless it is certainly more prominent and more turned up than in the species that I have placed in Section I. The clypeus is gently but very distinctly emarginate in front, the sides of the

emargination forming a very obtuse angle with each other. The entire head (including the clypeus) is very evenly punctulate. Subject to the above remarks the description of *H. diversiceps* may be read as applying to this species. It must be noted, however, that the clypeal suture is less straight being somewhat conspicuously angulated in the middle, that the prothorax is slightly less transverse and more narrowed anteriorly with the base a little more (and the front a little less) bisinuate, that the hind coxæ are scarcely so short, that the ventral segments are much more finely punctured, that the teeth on the front tibiæ are sharper, and that in the hind claws the produced apex of the basal piece seems a trifle larger.

Mulwala, N.S.W.; taken by Mr. T. G. Sloane.

H. QUADRATICOLLIS, sp.nov.

Minus elongatus; postice leviter dilatatus; sat nitidus; ferrugineus; pilis adpressis minus brevibus minus sparsim vestitus; sat crasse minus profunde minus crebre (clypeo sat crebre excepto) punctulatis; labro sat fortiter porrecto clypei superficiem haud attingenti; antennis 9-articulatis; unguiculis posticis appendiculatis, elongatis, gracilibus. [Long. $3\frac{2}{5}$, lat. $1\frac{4}{5}$ lines.

This species seems to be a close ally of the preceding three species although considerably larger than any of them. The head scarcely differs from that of *H. diversiceps* except in being a little wider, with the clypeus slightly more emarginate in front. The description of *H. diversiceps* may be read as applying to this insect with the following additional modifications:—the anterior angles of the prothorax, though scarcely so sharp, are much more prominent, the hind angles of the same are fairly defined, the base is evidently bisinuate and the puncturation is stronger and closer, being almost uniform with that of the elytra; the hind coxæ are much longer, being considerably longer than the second ventral segment, and (although *decidedly* yet) *not very much* shorter than the metasternum; the three external teeth of the front tibiæ are

quite sharp; the claws are decidedly longer, those of the hind legs being very slender with the basal piece scarcely twice (and its inner apical projection less than half) as large as the apical piece. In my unique example (a male) the front claws are bifid.

Port Lincoln, S. Australia.

H. FISSICEPS, sp nov.

Sat elongatus; postice minus dilatatus; sat nitidus; ferrugineus, pilis sat brevibus adpressis sparsim vestitus; capite toto crebre rugulose sat æqualiter, prothorace pygidioque leviter subtiliter minus crebre, elytris subtiliter sat crebre, punctulatis; clypeo antice profunde triangulariter exciso, labro clypei superficiem haud attingenti; antennis 9-articulatis; unguiculis bifidis.

[Long. 3, lat. $1\frac{2}{5}$ lines.

The anterior emargination of the clypeus (the reflexed border of which is strong and continuous) is so deep as to indent it not much less than half-way to the clypeal suture which is carinated and very conspicuous; the labrum is scarcely protruded forward and does not rise very near the level of the clypeus, but the deep excision of the latter renders it visible from above. The prothorax is a little more than $\frac{2}{3}$ again as wide as long, the base (which is moderately convex hindward all across) being about half again as wide as the front, which is moderately concave with fairly well-produced sharp angles; the sides are somewhat feebly arched and the hind angles are much rounded off; the puncturation is fine and lightly impressed, and spaced so that about 18 or 19 punctures of average distance apart would range down the middle line. The puncturation of the elytra is a little closer and a trifle stronger, their transverse wrinkling is little noticeable, their lateral fringe normal, their apical membrane scarcely developed. On the underside the hind coxæ are a good deal shorter than the metasternum; they and it are lightly and somewhat closely, but not finely, punctured. The puncturation of the ventral segments is sparse and so feeble as to be almost obsolete; the ventral series consist of fine hairs and are conspicuous. The hind femora are not

much wider than the intermediate, their inner apical angle being fairly defined. The three external teeth of the front tibiæ are strongly developed, but are not very sharp. The hind claws have a decidedly bifid appearance owing to the apical projection of the basal piece (the basal piece itself being fully twice as large as the apical) standing out very conspicuously, but when examined it is seen to be less than half as large as the apical piece.

Mulwala, N.S.W.; taken by Mr. T. G. Sloane.

H. EXCISUS, sp.nov.

Sat elongatus; postice vix dilatatus; minus nitidus; ferrugineo-piceus, pilis sat brevibus adpressis minus crebre vestitus; crebre subtiliter (capite crassius excepto) punctulatus; clypeo medio fortiter arcuatim exciso, labro clypei superficiem haud attingenti; antennis 9-articulatis; unguiculis appendiculatis.

[Long. 5, lat. $2\frac{2}{5}$ lines.

The clypeus is very peculiar in shape, appearing to have had a small (semicircular) piece cut out of the middle of its front, the cavity thus formed (reaching back about a third of the distance from the front margin to the clypeal suture) having a continuous reflexed margin, and leaving the labrum distinctly visible from above, although the latter does not rise to the level of the clypeus; the clypeus does not quite form a continuous plane with the rest of the head; the clypeal suture is well marked and feebly arched. The prothorax is $\frac{2}{3}$ again as wide as long, the base (which is scarcely bilobed and only feebly convex hindward) being not quite half again as wide as the front which is deeply concave with sharp strongly produced angles; the sides are gently arched in front and almost parallel behind, the hind angles (viewed from above) sharply rectangular; the puncturation is a little asperate and quite close, so that about 30 punctures or more of average distance apart would range down the middle line. The elytra are punctured smoothly and a little more finely and sparsely than the prothorax; their transverse wrinkling is fine and not very noticeable, their lateral fringe normal, their apical membrane obsolete. The under-

side is punctured about as closely as the elytra, the punctures on the metathorax being a little stronger than those of the elytra, and on the ventral segments scarcely so strong; the puncturation of the metathorax and hind coxæ becomes sparser towards the middle line (the latter having a well defined lævigate antero-internal space), that of the ventral segments scarcely sparser but evidently finer. The hind coxæ are about intermediate in length between the metathorax and 2nd ventral segment. The hind femora are a good deal wider than the intermediate and have their inner apical angles blunt but fairly defined. The ventral series consist of hairs and are not particularly conspicuous. The three external teeth of the front tibiæ are strong and sharp, the uppermost less than half as large as the 2nd. In the hind claws the basal piece is quite twice as large as the apical, its inner apical projection being small.

The puncturation of this species is extremely similar to that of *H. torvus*, Blackb.; compared with that of *H. piceus*, Blanch., it it is slightly finer and closer on the elytra, and much closer and more asperate on the prothorax.

Mulwala, N.S.W.; taken by Mr. T. G. Sloane.

H. OBESUS, Burm.

I feel little or no doubt of the correctness of my identification of this species, in which I am confirmed by Sir William Macleay. It appears to occur over an exceptionally extended area; I have seen examples from Woodville, Kangaroo Island, Victor Harbour, Port Lincoln (all in S. Australia), and King George's Sound. Structurally it is very close to *H. excisus*, Blackb., but differs very widely in superficial characters, the upper surface being almost glabrous, the puncturation infinitely less close (that of the hinder part of the head and of the prothorax feeble and sparse,—spaced so that about 12 or 13 punctures of average distance apart would range down the middle line of the prothorax,—that of the elytra almost as sparse but much stronger), the uppermost tooth of the front tibiæ smaller and the lower two teeth longer and sharper.

SECTION III. (GROUPS IV.-VII.).

The limits between this section and the preceding one are not as clearly defined as I could wish, as there are a few species in each section which I have placed there with more or less doubt. However, since all the species whose head presents the appearance of a "trilobed outline" belong to this section with the addition of very few others,—it will be only in respect of a very small number that doubt can arise ;—especially as in most or all of those placed in this section and yet not showing indications of a "trilobed outline" of the head,—the labrum rises *very markedly* above the clypeus.

GROUP IV.

Mr. T. G. Sloane has lately sent me two examples taken at Mulwala, N.S.W., that appear to be identical with my *H. submetallicus* from Port Lincoln.

GROUP V.

H. DUBIUS, Blackb.

I have recently received from Mr. McDougall (of Moonta) an example which perhaps belongs to this species, though it is smaller than the type (long. 4 lines) and of a much darker colour,—except the antennæ which are testaceous; it differs from the type also in being much more pubescent (the type is an old and probably abraded specimen) with the hind angles of the prothorax appearing slightly more defined, the apical membrane of the elytra a little more apparent and the external teeth of the front tibiæ a little sharper. It was taken near Adelaide.

H. NASUTUS, Blackb.

In the original description of this species the hind claws were called "appendiculate" without further remark,—but it would be well to note that the claws have very much the appearance of those which I have called "bifid," the inner apex of the basal

piece being very conspicuously produced; this produced apex however is very slender, and not quite half as large as the apical piece,—but I am not sure the insect would not be more at home among those with bifid claws.

H. PINGUIS, sp.nov.

Minus elongatus; postice dilatatus; sat nitidus; niger, elytris piceis, antennis, palpis, pedibusque obscure rufo-piceis; pilis brevibus adpressis griseis sat sparsim vestitus; capite crebre, prothorace et elytris minus crebre, sat crasse punctulatis; pygidio opaco subtiliter subcrebre punctulato; labro clypeum sat fortiter sat anguste superanti; antennis 8-articulatis; unguiculis posticis appendiculatis; coxis posticis metasterno sat brevioribus.

[Long. 5 (vix), lat. 2½ lines.

The head is unusually narrow; its "trilobed" appearance is very well defined, the middle lobe appearing scarcely so long, and about half as wide, as the lateral lobes. The margin of the clypeus is strongly reflexed except in the middle where it is quite obsolete; the clypeus does not form a continuous surface with the rest of the head from which it is separated by a feebly angular suture. The prothorax is about $\frac{2}{3}$ again as wide as long, its base (which is feebly bisinuate and moderately lobed hindward in the middle) being about $\frac{2}{3}$ again as wide as the front, which is rather strongly concave with fairly produced sharp angles; it is widest near the base; its sides are gently rounded; the hind angles appear fairly defined from the most favourable point of view, the puncturation is spaced so that about 15 or 16 punctures of average distance apart would range down the middle line. The transverse wrinkling of the elytra is moderately defined, their lateral fringe normal, their apical membrane very distinct. The hind coxæ are considerably shorter than the metasternum, and considerably longer than the 2nd ventral segment; they and the metasternum are punctured rather strongly,—somewhat closely at the sides, less so towards the middle,—the lævigate antero-internal space being scarcely defined. The ventral segments are punctured more finely,

—but somewhat evenly all across. The ventral series consist of stout testaceous hairs and are conspicuous. The hind femora are much wider than the intermediate and have their inner apical angle well defined. The external teeth of the anterior tibiæ are strong and blunt, the uppermost very close to and about half as large as the second. In the tabulation (P.L.S.N.S.W. 1889, p. 144) this species would fall under "GG," though the puncturation of the ventral segments is a little stronger than in *H. crassus*, *Augustæ*, and *Sloanei;* the hind angles of the prothorax are as in *H. Sloanei*, from which the present species differs *inter alia* by its much smaller head.

Sent to me by Sir William Macleay as *H. holomelænus*, Blanch., but that species is especially stated to have 9-jointed antennæ.

N. S. Wales.

GROUP VI.

H. POTENS, Blackb.

Among a miscellaneous batch of specimens sent to me some time ago by Mr. Sloane,—taken by him from flood refuse on the banks of the Murray,—I find a specimen which I cannot separate from *H. potens*; it differs, however, from all the numerous other examples I have seen in having the hairs on its upper surface all erect instead of recumbent. Whether the horrors of its situation when it fell into Mr. Sloane's hands made its hair thus stand on end I cannot say, but certainly it seems to possess no structural character suggestive of its being a distinct species.

The following species,—appertaining probably to my Section III. of *Heteronyx*,—I have been unable to identify. All of them except *H. unicolor*, Blanch., appear to have 9-jointed antennæ. The first 7 are from Tasmania, and very probable may be confined to that island.

H. Australis, Guér. Long. 5 lines. Not among the few Tasmanian *Heteronyces* I have seen. It would not be safe to apply

the name to any species from another locality without seeing the type.

H. hepaticus, Er. (stated by M. Blanchard to be identical with *H. Australis*).

H. fumatus, Er., *H. glabratus*, Er., *H. unicolor*, Blanch. Long. 4½ lines. The descriptions are too vague to be identified safely with any specimen not from Tasmania; none of the Tasmanians I have seen agree with them.

H. striatipennis, Blanch. (already referred to,—*vide* p. 671).

H. dimidiatus, Er. (already referred to,—*vide* p. 668).

H. obscurus, Blanch. From Raffles Bay, N. Australia. Long. 4½ lines. A black species, with the club of the antennæ black; I feel sure I have not seen it.

H. pilosus, Blanch. From Raffles Bay. Long. 3-3½ lines. A pale-coloured, very pilose species; the prothorax very finely, the elytra very deeply punctulate. I feel sure I have not seen it.

H. pellucidus, Burm. Long. 3 lines. From S. Australia. I cannot identify this description with any of the numerous S. Australian *Heteronyces* before me. The species seems to be a very distinct one,—of testaceous colour, with the prothorax almost lævigate, elytra fairly strongly punctulate, front tibiæ with 2 well-defined teeth and also a minute notch close to the knee, front claws of ♂ unequal *inter se*.

H. proximus, Burm. Long. 5 lines. From W. Australia. Said to be very like *H. agrestis* but even more finely punctured. I have seen nothing from W. Australia agreeing with these characters; the description is not detailed enough to justify its identification with species from other parts of the continent, especially since the presumption is strongly against a W. Australian species of *Heteronyx* occurring elsewhere. *H. obesus* is the solitary instance known to me of such a distribution,—unless the tropical examples of *H. agrestis (?)* referred to on page 688 be

an example in point,—but I am convinced they will prove to represent a distinct species when more material can be examined.

H. holomelænus, Blanch. Long. 5 lines. From Eastern Australia (already referred to,—*vide* pp. 1218, 1243). An entirely black insect with the club of the antennæ pitchy-red,—closely punctulate. Perhaps near *H. rhinastus*, Blackb., which however has testaceous antennæ. The note as to the unusual colour of the antennæ is the only mention of a really marked character in Blanchard's description.

H. laticollis, Blanch. Long. 5½ lines. From Eastern Australia. The head and prothorax appear to be much wider than in any species known to me and in other respects likely to be identical. The other characters mentioned in the description are all vague.

H. nigritus, Blanch. Long. 3½ lines. From Eastern Australia. A black species with testaceous antennæ and palpi, and pitchy or reddish legs; so far suggestive of *nigrinus*, Blackb.,—but the species as compared with the preceding is said to be "planior" and the elytra are called "fere planis" which seems to remove it far from my *nigrinus*.

H. oblongus, Blanch. Long. 4½ lines. From Eastern Australia. There is no salient character mentioned in the description of this insect which would apply to not a few of the examples before me; I cannot identify it with any one in particular. The species appears to be of a brownish-red colour, to have some ashy pubescence,—the prothorax to be very slightly wider than the elytra (if this is strictly correct I am convinced that I have not seen the species) and finely punctulate,—the elytra to be finely punctulate-rugulose, and the pygidium closely punctulate. This is all the information contained in the description.

H. ovatus, Blanch. Long. 3-4 lines. From Eastern Australia and Tasmania. Notwithstanding its name the form of this species is said to be "oblongus." The description is almost in the same words as that of *H. oblongus*,—from which it appears to differ by being slightly smaller, with less silky pubescence and the prothorax

scarcely so wide as the elytra. Such statements as the last of these are quite useless unless they be founded on exact measurements. I know no *particular* species that agrees with this description though it would come near fitting a good many.

H. rubriceps, Blanch. Long. 6 lines. From Eastern Australia. Prothorax said to be wider than elytra, and elytra almost flat,—head appears to be conspicuously reddish. I have seen no large species presenting these characters.

H. rufo-marginatus, Blanch. Long. 4½-5 lines. From Eastern Australia. The conspicuously red margin of the elytra and prothorax would seem to distinguish this species strongly from all known to me. It is perhaps not unlike *H. marginatus*, Blackb., following the description of which some remarks on it will be found.

NOTES ON AUSTRALIAN COLEOPTERA, WITH DESCRIPTIONS OF NEW SPECIES.

By the Rev. T. Blackburn, B.A., Corr. Mem. Linn. Soc. N.S.W.

Part V.

CARABIDÆ.

Silphomorpha amabilis, Cast.

Among the insects taken by Dr. Bovill in the N. Territory of S. Australia is a specimen that seems to appertain to this species, though it is difficult to be quite sure as Count Castelnau's description deals only with colour and markings. In respect of these the example before me shows the following discrepancies,—the prothorax instead of being "yellow with a large black spot occupying its centre" is black with the lateral margins broadly yellow and the front and hindmargins narrowly pitchy-red; the base of the elytra instead of having "a black spot near the centre" is narrowly black on its inner half, with the black colour a little dilated at its outer extremity. The elytra are widely and feebly (but quite regularly and distinctly) costate, a wavy and very fine scratch-like stria running between each two costæ. The species may be readily recognized by the remarkable resemblance of the black markings (excluding the narrow black edging of the apex), when viewed with the head towards the observer, to the figure of a tree,—the black front portion of the suture representing the trunk, and the mark that Castelnau calls a "black fascia" representing the branches and foliage.

Scolyptus obscuripes, sp.nov.

Minus elongatus; minus nitidus; niger, antennis palpisque rufescentibus, tarsis rufo-piceis; menti dente lato triangulari lobis

lateralibus multo breviori, his coriaceis longitudinaliter leviter striatis; antennis brevibus, apicem versus articulis (ultimo excepto) subquadratis; clypeo antice convexo sat fortiter reflexo; vertice convexo lævi; prothoracis longitudine latitudini æquali antice sat angustato, basi utrinque fovea (vix antice lineatim producta) leviter impresso; elytris sat fortiter convexis, striatis; striis internis antice sat fortiter impressis et distincte punctulatis, lateralibus totis (omnibus postice) leviter impressis et vix punctulatis; interstitio 3° 4-punctulato; epistomatis alis antice haud lateraliter dilatatis; tibiis anticis extus tridentatis, dentibus acutis sat elongatis. [Long. $6\frac{1}{2}$, lat. $1\frac{4}{5}$ lines.

A much less elongate and less parallel species than *S. procerus*, Putz., remarkable by the structure of the front of its clypeus, the reflexed margin of the lateral wings being continued evenly all across in a gentle arch as the front margin of the clypeus. The lateral wings of the clypeus resemble those of *S. procerus*, not being prominent laterally at their apex (as they are in *S. rugiceps*, Macl., which M. Putzeys affirms to be his *S. planiceps*); the antennæ however are considerably shorter than in that species, joints 8-10 being little or not longer than wide; while the prothorax scarcely differs, being nevertheless a trifle less narrowed in front and having the impression on either side near the base more like an oblong feeble fovea and scarcely produced forward as an impressed line. The sculpture of the elytra closely resembles that of *S. procerus*, though the striæ are somewhat stronger and the interstices a little more inclined to convexity, especially in front. The anterior tibiæ resemble those of *S. procerus*, but the external teeth are distinctly longer (resembling the lower three in *S. rugiceps*, Macl.), and the inner apical spine is slightly shorter than in the female of that species; the median tooth of the mentum is evidently more pointed in front.

The example before me appears to be a female; it is likely that in the male the inner apical spine of the anterior tibiæ is differently formed, and the tibia itself narrower and less strongly dentate externally.

Of the previously named species of this genus, *abbreviatus*, Putz., *crassicollis*, Putz., and *prominens*, Putz., are not described, their author having merely, in notes consisting of three or four lines, mentioned three or four points of difference between them and *S. oblongus*, *planiceps*, and *procerus* respectively; they appear to be so extremely close to those species as almost certainly to differ similarly from the present one in most respects. From *planiceps* and *procerus*, as well as *marginatus*, Putz., its stout short antennæ,—with subapical joints almost transverse, sufficiently distinguish *S. obscuripes*. *S. oblongus* and its satellite (*abbreviatus*) appear to have antennæ more or less resembling those of the present species,—but in *oblongus* the elytra are said to be "simply striated," and *abbreviatus* is differentiated from *oblongus* by there being "traces of puncturation towards the base of the internal striæ,"—whereas in *S. obscuripes* the elytral striæ are punctured almost as in *S. planiceps*, except that close to the lateral margin the striæ and puncturation alike become feeble. In *S. oblongus* (and presumably in *abbreviatus*) moreover the external teeth of the front tibiæ should be shorter than in *procerus*, whereas in the example of *obscuripes* before me they are longer than in either sex of *procerus*. In *S. foveiceps*, Macl., *inter alia*, the structure of the legs is said to be as in *S. rugiceps*, in which case the front tibiæ are very much wider than in *S. obscuripes*. From all the described species, unless *foveiceps*, the present insect seems to differ in the dark colour of its legs. There seems to have been some ambiguity in the terms employed to describe the external dentation of the anterior tibiæ in *Scolyptus*; the apical external extension of the tibia itself apparently having been by various authors excluded in numbering the teeth.

In calling the anterior tibiæ of the present species "tridentate" externally, I have included the curved produced apex of the tibia itself,—as is usual in characterizing species of *Carenum*, &c.

Burrundie, N. Terr. of S. Australia; taken by Dr. Bovill.

PHYSOLESTHUS PALLIDUS, sp.nov.

♂. Sat angustus; obscure testaceus, elytris piceo-umbratis; capite inter oculos transversim depresso, hoc prothoraceque subcoriaceis haud distincte punctulatis; prothorace transverso; elytris leviter striatis, interstitio 3° 2-punctulato.

[Long. $2\frac{1}{5}$, lat. $\frac{4}{5}$ lines.

The prothorax is nearly half again as wide as long, the front margin equal in width to the base, the dorsal channel very feeble; the hind angles are obtuse, the reflexed lateral margins not very wide in front but near and around the hind angles becoming extremely so; along the front margin are some fine longitudinal wrinkles. The piceous clouding of the elytra is chiefly about the suture and apex, and is very little defined. It is just possible that the sudden transverse flattening of the head between the eyes may be a malformation,—but as it is quite symmetrical its presence is more likely to be normal.

Of much smaller size and lighter colour than *P. australis*, Chaud., and *suturalis*, Cast. Compared with *P. grandipalpis*, Macl., it would seem *inter alia* to be considerably smaller, with the elytra much more feebly striated,—besides differing in colour.

S. Australia; Murray Bridge.

LECANOMERUS FLAVOCINCTUS, Blackb.

It is possible that this species is identical with *L. insidiosus*, Chaud., but unfortunately the latter has not been described, M. de Chaudoir having merely stated its size and colour, and compared it with *Stenolophus proximus*, Dej., a species I do not possess. If errors occur through such useless descriptions the author of the latter must be held responsible.

NOTOPHILUS.

When I characterized this genus (Tr. Roy. Soc. S.A., 1887, p. 185), I omitted to state that the 2nd joint of the labial palpi is bi-setose, as in *Lecanomerus* and *Thenarotes*. In *Haplaner* also the same joint is bi-setose.

LAMELLICORNES.

Coptodactyla bailey, sp.nov.

♀ (?).—Nigra ; nitida ; convexa ; oblongo-cylindrica ; capite (vertice lævi excepto) transversim rugulato ; clypeo antice rotundato ; prothorace angulos anticos versus punctulato, antice utrinque a foveola laterali usque ad angulos anticos carinato ; elytris crenato-striatis, punctis latera versus minoribus, stria nona simplici et ante medium in margine laterali desinente ; pygidio convexo, lævi ; tibiis anticis brevibus, apice acuminatis, externe inermibus.

[Long. 6, lat. 4 lines (vix).

Extremely like *C. glabricollis*, Hope, but different from it in the clypeus being evenly rounded in front without any emargination whatever, and in the front tibiæ being very short, narrowed to a sharp point at the apex and unarmed externally. The front legs are devoid of tarsi in the example before me, but it is just possible these may have been broken off.

Queensland, Mount Bellenden-Ker; taken by Mr. F. M. Bailey.

Novapus laticollis, sp.nov.

Latus ; sat nitidus ; subtus dense rufo-hirsutus ; prothorace basin versus angustato, margine basali integro ; elytris sub-punctulato-striatis.

Maris capite cornu lato, apicem versus recurvo, apice leviter dilatato et emarginato ; prothorace (quam longiori partibus duabus latiori) a basi ad apicem profunde excavato, partis excavatæ lateribus perpendicularibus, fundo lævgiato vel vix sculpturato..

[Long. (♂♀ $10\frac{1}{2}$, lat. ♂ 6, ♀ $5\frac{1}{2}$ lines.

From *N. Adelaidæ*, Blackb., this species differs in being proportionately much wider,—less than twice as long as wide (of both species I have seen a good many specimens which do not appear to vary in proportions) ; from *N. striatopunctulatus*, Blackb., in

the sculpture of the elytra; from both it differs in the very much larger and deeper excavation of the prothorax in the ♂, a difference somewhat difficult to express in specific terms, but the following will perhaps avail:—the perpendicular depth of the excavation is as great as its greatest width (in the other species much less); if the excavation be examined by looking along the insect (longitudinally) from behind, the specimen being held so that the eye has the base of the prothorax just exactly covering the apex of the same (beyond which the frontal horn rises), the outline of the excavation appears as an exact semicircle (or even slightly more than a semicircle) while in the other species it is much *less* than a semicircle; it also differs from both the above-named species in the almost perfect smoothness of that portion of the surface of the prothorax which falls within the excavation (such sculpture as there is consisting in very minute and sparse granulation); the same part in *Adelaidæ* and *striatopunctulatus* being reticulately strigose. The female does not differ notably from that of *N. Adelaidæ* except in its wider proportions. The female of *N. striatopunctulatus* is unknown.

From *N. simplex*, Shp., the present species differs in its frontal horn being notched at the apex, and from *N. crassus*, Shp., in the prothoracic excavation not being in the smallest degree "rugulosely punctulate."

N. crassus, Shp., differs *in toto* from the two species of which the female is known to me by the characters of that sex, which include a tubercle on the head and an excavation on the prothorax. Is it possible that Dr. Sharp may be mistaken in regarding this insect as ♀ *Novapus*? The question is suggested by the fact that for a long time (and until positive information enlightened me) I regarded as the ♀ of *N. Adelaidæ* an insect which has a tubercle on the forehead and a gentle excavation on the front of the prothorax, but which I have since ascertained to be certainly not *Novapus* (I believe it to be *Semanopterus subæqualis*, Hope).

If this might be so my *N. Adelaidæ* would be very near *N. crassus*, Shp., but would appear to differ from it in its much

narrower proportions,—no specimen that I have seen being shorter than twice its width, as well as in the interior surface of the prothoracic excavation in the male not being rugulosely punctulate.

Near Eucla, W. Australia ; taken by Mrs. Graham.

CAVONUS ARMATUS, Shp. ♀.

Among a small batch of *Cavonus armatus*, Shp., recently sent to me by Mr. McDougall of Moonta were two females, which had been dug up from the ground. This sex differs from the male in the following characters ;—the club of the antennæ is very much smaller being shorter than the preceding joints taken together ; the surface of the prothorax is quite even, that part which in the male is excavated being very distinctly but not very closely punctulate ;—the rest lævigate or nearly so ; the pygidium is much less abruptly declivous and less strongly fringed with hairs above.

PHYLLIOCEPHALA, gen.nov. *(Corynophyllo affinis)*.

♂.—Mentum sat angustum, elongatum, antice gradatim angustatum (fere ut *Corynophylli*). Palpi labiales articulo ultimo sat valido, obconico (quam *Corynophylli* paullo breviori). Maxillæ lobo superiore parvo (fere ut *Cavoni*). Palpi maxillares articulo 2° sat incrassato, articulo ultimo sat elongato fortius incrassato, subovato (quam *Cavoni Corynophillive* multo magis incrassato). Mandibulæ haud prominentes. Labrum vix perspicuum. Antennæ 10-articulatæ, flabello elongato minus lato. Caput cornu valido acuto. instructum, ante oculos utrinque fortiter (quam *Cavoni Corynophyllive* multo magis fortiter) dilatatum, antice declivum. Prothorax (fere ut *Cavoni*) profunde excavatus utrinque sat fortiter elevatus sed haud antice cornutus. Tibiæ anticæ obtuse tridentatæ ; posteriores sat graciles, apice truncatæ ciliatæque. Tarsi graciles, tibiis fere longiores. Stridulationis organa nulla.

♀. Latet.

The superficial resemblance of this genus to *Cavonus* is quite remarkable,—so much so that when I first saw it I passed it over

as being *C. armatus*, Shp. On examination, however, its horn (which is quite like that of *C. armatus*) is seen to be on the *head* (not on the front of the prothorax), the lateral dilatation of the head in front of each eye to be much larger (giving the head some resemblance to the shape of a trilobed leaf), the flabellum of the antennæ to be wider, the mentum to be much narrower, and the apical joint of all the palpi to be much stouter.

From *Neocavonus* the present genus differs *inter alia* in the shape of its mentum, in the apical joint of its maxillary palpi not truncate (or scarcely so), in the absence of a prothoracic and presence of a frontal horn, and in the much larger flabellum of its antennæ.

From *Aneurystypus* it differs *inter alia* in the proportionally much wider mentum, in the much shorter and stouter apical joint of the labial palpi, in the much smaller flabellum of the antennæ, and in the absence of a prothoracic and presence of a frontal horn.

From *Corynophyllus* it has been distinguished in the Latin diagnosis (above).

From *Teinogenys* (which I do not think that I have seen) it would seem to differ *inter alia* in the mentum not being "compressed."

From all the above genera the extremely strong dilatation of the head on either side in front of the eyes would seem a sufficient distinction.

PHYLLIOCEPHALA NIGRO-HIRTA, sp.nov.

♂.—Nitida; nigerrima; supra glabra, corpore subtus pedibusque longe sat dense nigro-hirtis; clypeo antice rotundato, marginibus fortiter reflexis; capite cornu valido, recurvo, apice sat acuto, antennarum flabello vix breviori, instructo; prothorace quam longiori plus dimidia parte latiori, a margine antico fere ad basin profunde excavato, sparsim subtilius punctulato, partis excavatæ lateribus angulatim elevatis fundo transversim strigato; scutello antice punctulato; elytris (stria suturali punctulata, et

basi vage sparsim punctulata, exceptis) sublævigatis; pygidio leviter squamose punctulato, medio longitudinaliter sat anguste lævigato. [Long. $8\frac{1}{2}$, lat. $4\frac{4}{5}$ lines.

Near Eucla, W. Austr.; taken by Mrs. Graham.

NEOHETERONYX, gen.nov. *(Heteronyci affinis).*

Heteronyce differt mento fortiter convexo, minus lato; palpis maxillaribus gracilibus elongatis; maris tarsis anticis intermediisque sat fortiter dilatatis.

So many of the characters that have been relied upon as generic in the *Melolonthidæ* (*e.g.*, the number of joints in the antennæ) have been found unreliable when fresh species have been discovered, that I think it better to assume the possibility of a like uncertainty of character in this genus, and to characterize it merely by the salient points mentioned above. The following will probably be found to be also generic characters,—although some of them may perhaps eventually prove to be merely specific.

Antennæ 8-jointed, club consisting of 3 joints, each of which is (in both sexes) nearly as long as the preceding four joints together. Labrum horizontal, altogether below the level of the clypeus, but distinctly visible (owing to its forward projection) if the clypeus be looked down upon from a point perpendicularly above its surface. Eyes large, entire. Clypeus moderately reflexed, its sides not at all convergent hindward immediately in front of the eyes. Hind coxæ on the external margin even shorter than the 2nd ventral segment,—their external hind angle quite rounded off. Front tibiæ of male (*i.e.*, of the sex with dilated tarsi) bidentate externally, of female simple; claws appendiculate, the basal piece strongly compressed, the apical piece as long as the basal, and slender. The pygidium is exposed.

N. LIVIDUS, sp.nov.

Oblongus; subglaber, pygidio, pedibus segmentisque ventralibus pilis sparsim vestitis; brunneo-lividus, capite prothorace

tarsisque maculatim infuscatis, pedibus antennisque testaceis; sat fortiter sat crebre (elytris sublineatim) punctulatus.

[Long. $2\frac{3}{5}$ (vix), lat. $1\frac{1}{5}$ lines.

The head is longer and scarcely narrower than the prothorax, which is twice as wide as long, its base (which is scarcely bisinuate and but little lobed hindward in the middle) being very little wider than the front, which is moderately concave, with angles moderately sharp and not much produced; the hind angles are fairly distinct but not at all sharp. The general facies is very similar to *Heteronyx*, though the head looks disproportionately large.

N. Territory of S. Australia; taken by Mrs. Bovill.

BUPRESTIDÆ.

Astræus mastersi, Macl.

There seems to be no doubt that this is identical with *A. Samouellei*, Saund. The species is a very distinct one, and the descriptions are almost word for word the same. *A. pygmæus*, Poll., does not appear to differ except in the absence of the sub-apical yellow spot on the elytra. The author seems to have some doubt as to the specific value of his name. I have not myself seen a specimen without the sub-apical spot; but as some of the other spots undoubtedly vary, I should hesitate much to regard *A. pygmæus* as more than a var., especially as in the following species I find a precisely similar variation.

A. meyricki, sp.nov.

Nitidus; postice ab elytrorum basi fortiter angustatus; læte cupreus, capite prothoraceque obscurioribus vel virescentibus, hoc certo adspectu cyanescenti, elytris flavo-bifasciatis (fasciis suturam haud admodum attingentibus, anteriori sat angusta vix ante medium posita, posteriori paullo ante apicem magis etiam angusta) et maculis binis flavis ornatis (harum altera ovali longitudinaliter ad basin in interstitio 3° posita, altera lineari inter fasciam posteriorem et apicem posita); subtus sat dense argenteo-pubescens;

capite (hoc longitudinaliter sulcato) prothorace et corpore subtus sat dense subrugulose punctulatis; elytris fortiter anguste 11-costatis, interstitiis latis subconcavis seriatim punctulatis; antennis tarsisque cyanescentibus.

[Long. $4\frac{4}{5}$-$5\frac{3}{5}$, lat. 2 (vix)-$2\frac{2}{5}$ lines.

Var. Elytrorum fascia posteriori in medio anguste interrupta, macula subapicali deficienti.

The prothorax across the base is about three times as wide as the length from its apical margin to the front of the projecting elytral lobes, and is quite twice as wide at the base as in front. Each elytron at the sutural apex forms a very strong sharp process curved outward, above which externally is a much smaller but equally sharp process also directed outward. The apical dehiscence of the elytra commences scarcely above the upper spine. The 2nd, 3rd, 4th, and 5th costæ on the elytra are very oblique, terminating on the 1st costa at successively greater distances down its length.

Seems to resemble *Conognatha navarchis*, Thoms., (from Tasmania),—which I should judge from the description to be an *Astræus*,—but appears to differ from it as follows:—the size of *A. Meyricki* is very much less than of *C. navarchis*, the basal and sub-apical elytral spots appear to be wanting in the latter, and the anterior fascia reaches the suture. In *C. navarchis* the labrum is said to be pale yellow and the tarsi to be brown, there is no mention of the quite dense silvery pubescence which clothes the underside of *A. Meyricki*, and the forehead is said to be carinated. No doubt there are other differences; as the description of *C. navarchis* is very incomplete, not mentioning (*e.g.*) the position of the fasciæ on the elytra or the presence of any costæ on the same. Probably the yellow elytral markings (which are of a pale sulphur hue) are subject to considerable variation.

W. Australia; taken by E. Meyrick, Esq.

A. MAJOR, sp.nov.

Subnitidus; postice minus angustatus; æneus plus minus cupreo- (vel violaceo-) micans, femoribus tibiisque plus minus

testaceis, elytris flavo- 3-fasciatis (fascia 1 basali sat angusta, 2ª latiori sola suturam admodum attingenti paullo ante medium, 3ª sat angusta ab apice sat procul) et macula elongata sanguinea subapicali ornatis, lateribus quoque maculatim sanguineis; corpore subtus latera versus argenteo-pubescenti; capite (hoc sat convexo) prothorace et corpore subtus (abdomine vix ruguloso excepto) crebre rugulose punctulatis; elytris fortiter striatis, striis subtilius punctulatis, interstitiis sat convexis sparsim sat fortiter punctulatis; antennis tarsisque viridibus vel cyaneis.

[Long. 7-8, lat. 3-3½ lines.

The prothorax across the base is distinctly less than three times as wide as the length from its apical margin to the front of the projecting elytral lobes, and is not quite twice as wide across the base as in front. Each elytron is spined at the apex scarcely differently from those of the preceding species, but the elytra begin to diverge further from their apex, so that the sutural spines are more widely separated. The 6th stria meets the sutural stria at its apex enclosing the 2nd, 3rd, 4th, and 5th. The sanguineous portions of the lateral margins are identical with the lateral margins of the fasciæ, with the addition of that portion of the lateral margin which lies between the basal and ante-median fasciæ. All the femora and tibiæ are testaceous (with a coppery gloss) in one of the examples before me, in the other example all the knees and the hind femora are suffused with an æneous tone that obscures the testaceous appearance. The sides of the elytra are somewhat concave behind the shoulders, bulging out again slightly to about the middle, whence they are gradually convergent to the apex.

S. Australia; an example in my own collection, and one taken by Mr. J. G. O. Tepper at Monarto on Eucalyptus flowers.

A. TEPPERI, sp.nov.

Subnitidus; postice minus angustatus; niger plus minus æneo-tinctus, elytris singulis 8-maculatis; corpore subtus sat dense argenteo-pubescenti; capite (hoc sat convexo) prothorace et

corpore subtus crebre aspere (prothorace ad latera magis rugulose) punctulatis; elytris ut *A. Meyricki* sculpturatis, his nihilo minus apice magis dehiscentibus. [Long. $3\frac{3}{5}$-$4\frac{4}{5}$, lat. $1\frac{3}{5}$-2 lines.

The shape of the prothorax and elytra is as in *A. major*, the surface sculpture of the latter (*i.e.*, the elytra) being quite as in *A. Meyricki.* The yellow spots on each elytron are as follows:—an elongate quadrate spot close to the base extending transversely from the 2nd to the 5th costa, a transversely oval spot from the 1st to the 5th costa a little in front of the middle, a much smaller spot just behind the middle and in a line with the preceding two, another (also small) in the same line and much nearer to the 3rd spot than to the apex, three spots (all about equal in size to that first named) on the lateral margin opposite the interstices between the 1st and 2nd, 2nd and 3rd, and 3rd and 4th dorsal spots, and one (a little before the apex about half way across the elytron) which might be regarded as belonging to either the dorsal or marginal series.

This species bears in the Adelaide Museum the name I have given to it, but I cannot find any published description.

S. Australia; said to occur on flowers of *Melaleuca parvifolia* in the neighbourhood of the Murray.

ELATERIDÆ.

Alaus Darwini, sp.nov.

Angustus; sat parallelus; sat convexus; nigro-piceus; supra pilis squamiformibus (alteris albidis, alteris nigro-fuscis) dense tectus, his utriusque coloris maculatim condensatis, maculis in prothoracis disco utrinque, et in elytris (his basi utrinque sanguineis) latera versus, præcipue perspicuis; subtus dense sat æqualiter albido-pubescens; pedibus antennarumque basi plus minus rufescentibus; capite prothoraceque fortiter crebrius punctulatis (puncturis sub pilis abditis); illo antice leviter concavo; hoc tumido, quam latiori fere tertia parte longiori, lateribus leviter arcuatis, basi quam margo anticus fere dimidia parte latiori; elytris leviter punctulato-striatis, apice vix emarginato-truncatis, scutellum versus utrinque

sat tumidis, striis (et in striis puncturis) a basi ad apicem gradatim obsolescentibus, interstitiis subtiliter minus crebre, basin versus confertim sat aspere, punctulatis. [Long. $8\frac{1}{2}$, lat. $2\frac{1}{5}$ lines.

The prothorax is very convex in all parts, being strongly declivous at both sides and ends; its most abrupt declivity is behind but (except as that makes it so) it can hardly be called tumid or tuberculate in front of the scutellum; on a casual glance the prothorax appears subcylindrical and parallel, but on more careful inspection it is seen that the sides in their middle part are gently rounded, thence considerably and roundly convergent at the extreme front and also convergent close to the base, but divergent again at the posterior angles which are considerably produced and very sharp; there is a lævigate line down the middle. The scutellum is of the form of a mitre and is placed on the face of an abrupt declivity similar and opposite to the hind declivity of the prothorax, there being on the latter two vague impressions corresponding in position to the two tumidities which are placed one on either side of the scutellum. The example before me is evidently a little abraded, but it is clear that a fresh specimen would be densely clothed with scale-like pilosity entirely hiding the sculpture from view. On the head and prothorax this pilosity is for the most part white or greyish-white, and on the latter there are blackish-brown masses of pilosity almost confined to the middle part of the segment (apparently along its whole length); this dark pilosity is most conspicuous where it assumes the form of an almost round and well limited spot on either side of the middle line a little nearer to the front than to the base,—behind which and about half way to the base is a similar but smaller spot on either side of the middle line. My unique example is glabrous down the middle line, and if this be the result of abrasion it is probable that in a perfectly fresh specimen these discoidal spots of the prothorax may be connected by continuous pilosity with a strip of blackish pilosity running down the middle line of which they would perhaps appear as lateral extensions merely. On the elytra the most conspicuous marking appears to be a space covered with black pilosity commencing on the lateral

margins immediately in front of the middle and running in a fascia-like form towards the suture, before reaching which, however, it turns upward and runs forward towards the scutellum; it is edged before and behind, close to the lateral margin, by the whitest part of the elytral pilosity; a fascia of blackish pilosity traverses the elytra a little before the apex; the elytra are bright red at the base (much as in *Monocrepidius Australasiæ*) but the redness being of the derm it is almost unnoticeable beneath the whitish pilosity. Probably in a perfectly fresh specimen the elytra are decidedly whitish with the sutural region for the most part darker and sending out (a) a festoon-like ramification on either side from near the scutellum to the middle of the lateral margin, (b) a fascia-like ramification on either side near the apex. The elytra are not symmetrical in the example before me, one of them being almost evenly rounded at the apex,—the other decidedly though lightly emarginate-truncate.

N. Territory of S. Australia; taken by Dr. Bovill.

N.B.—Sir William Macleay (Proc. L.S.N.S.W. 1888, p. 1240) mentions an *Alaus* from King's Sound which he regards as a var. of *A. funebris*, Cand., distinguished by smaller size and the presence of two round black spots on the prothorax. The distinctive characters mentioned are certainly suggestive of the present insect, which on the other hand is far too different from *funebris* to be regarded as a var., the prothorax (*e.g.*) in *funebris* being laterally dilated behind the front, with a bi-angular projection anteriorly and a strong tubercle in front of the scutellum.

BOSTRYCHIDÆ.

Species of this family seem to be rather numerous in Australia although very few have been described,—viz., 3 species attributed in Masters' Catalogue to *Bostrychus*, 4 to *Rhizopertha*, and one since referred to a new genus,—*Apatodes*. *B. Jesuita*, Fab., appears to be a genuine *Bostrychus*. Concerning the generic characters of the four described by Sir William Macleay, there is no information beyond their author calling two of them *Bostrychus*, and 2 *Rhizopertha*. The species described by Germar and

Erichson are called *Apate* by their authors, and I am not aware on what ground Mr. Masters has referred them to *Rhizopertha*. I am myself the author of *Apatodes*.

The four species of Sir W. Macleay are from Queensland, and all appear to have strongly marked elytral sculpture differing widely from that of any species known to me. *Apate collaris*, Er., is described as a small species with the elytra retuse-truncate and bidentate behind, and the prothorax of a bright red colour; I shall refer to it again below. *A. obsipa*, Germ., appears to be a remarkable insect having opaque pilose elytra, and is one of the few of Germar's Australian species not known to me.

The following species are from S. Australia.

The first of them and *A. collaris*, Er., may, I think, be attributed to *Apate*. They present the following characters which are almost identical with those attributed to *Apate* by M. Lacordaire, viz.,—head invisible from above; antennæ of 10 joints, joints 1 and 2 being together about as long as 3-7 together, joints 8-10 serrated (8 and 9 transverse) together about equal to the preceding 7 together in length; tarsi slender and elongated, joints 2 and 5 much longer than the rest; elytra retuse behind, variously spined. The next two species may perhaps for the present stand in the genus *Xylopertha* as characterized by M. Lacordaire, in common with which they present the following characters,—head invisible from above; antennæ of 10 joints, 1 and 2 being together about as long as 3-7 together, joints 8-10 together considerably longer than the preceding 7 together, 8 and 9 nearly as wide as long, apical joint elongate-cylindric, nearly as long as the preceding two together; of the tarsi joint 5 is longest, 2 and 3 nearly equal and each a little shorter than 5, joints 1 and 4 short, elytra behind simply retuse. The following characters are peculiar and would perhaps justify a new generic name for the species presenting them,—(a) posterior 4 tarsi strongly compressed, so that viewed from above they appear excessively slender—almost hair like, (b) sexual characters strongly defined, one sex (no doubt the male) of at least one species having anterior tarsi clothed

moderately thickly all over with very long and very fine hairs, elytra sculptured in the apical part differently from those of the other sex, and the form much narrower and more elongate in respect of both the prothorax and the elytra.

Apate lindi, sp.nov.

Nitida; glabra; picea, capite prothorace pedibusque rufis, elytris hic illic rufescentibus; capite crebre ruguloso; prothorace elytrorum latitudine, leviter transverso, postice leviter sparsim sat crasse punctulato, antice fortiter tuberculato-ruguloso, utrinque ad marginem lateralem antice spinis 3 conspicuis (harum antica maxima uncinata) armato, basi quam antice fere duplo latiori, angulis posticis rotundatis; elytris prothorace plus duplo longioribus, sat crebre (a basi ad apicem gradatim magis fortiter et magis crasse, pone medium valde rugulose) punctulatis, postice declivibus, parte declivi haud carina circumcincta, utrinque spinis 2 (spina superiori parva compressa, inferiori permagna retrorsum directa intus fortiter curvata) armata, sutura a basi ad apicem gradatim magis elevata, humeris lævibus. [Long. 1-2, lat $\frac{3}{10}$-$\frac{3}{5}$ lines.

Viewed from the side both the apical spines of the elytra are seen to project horizontally hindward; viewed from above the upper (and smaller) spines, which are considerably nearer to each other than the lower ones, are seen to be almost parallel,—while the lower ones (which are more than twice as long as the other pair and are about as long as the non-rugulose portion of the prothorax on the middle line) curve in a convergent direction so that their apices are not so far apart as the apices of the upper pair of spines. Immediately below the large spine and a little nearer to the lateral margin is a third prominence which however is small, very obtuse and little conspicuous.

Port Lincoln, S.A.; cut out of burrows in a living Eucalyptus.

A. collaris, Er.

I possess an example which I believe to be this insect; I cut it out of a burrow in a living Eucalyptus on Mount Lofty near

Adelaide. It agrees very well with Erichson's description, and is certainly not a *Rhizopertha* but may well stand in *Apate*, where its author placed it. An example taken by Mr. J. Anderson at Port Lincoln, is narrower and more elongate than that just referred to; I take this difference to be sexual; the elytra moreover are not rufescent at the base as in Erichson's description and the Adelaide specimen. In both these I find the slightest possible indication in some lights of two or three costæ (not mentioned by Erichson) running down the elytra.

XYLOPERTHA MYSTICA, sp.nov.

♂. Elongata; cylindrica; sat nitida; glabra; picea, antennis palpis tarsisque testaceis, femoribus tibiisque rufescentibus; capite sat elongato, longitudinaliter sat crebre strigato, antennis prothorace vix brevioribus; prothorace elytrorum latitudine, quam latiori fere longiori, antice sat angustato, postice subtilius sparsim conspicue punctulato, antice crebre granulato-ruguloso tuberculis nonnullis majoribus intermixtis (præcipue latera versus), utrinque unco supra oculum haud armato; elytris crebrius fortius vix rugulose (apicem versus vix magis fortiter) punctulatis, postice minus abrupte declivibus, apice singulatim valde productis et intus acute angustatis, parte declivi ad latera carinata et utrinque concava, sutura antice plana in parte declivi sat fortiter carinata, apice minute spinoso-producta, humeris lævibus; tarsis posterioribus 4 gracilibus compressis, supra visis fere capilliformibus, tarsis anticis perlonge pilosis; tibiis anticis subtus minute denticulatis. [Long. $1\frac{4}{5}$, lat. $\frac{2}{5}$ lines.

The non-declivous portion of the elytra is quite twice as long as the declivous part. The denticulations under the front tibiæ are scarcely noticeable without the aid of a compound microscope.

In company with the specimen described, I found an example which I have no doubt was the female of the same species, but unfortunately I broke it to pieces in trying to examine its mouth organs. It differed from the male in being a much shorter and wider insect with the front tarsi not pilose, and

the posterior declivity of the elytra larger, more strongly defined, and quite flat; the posterior declivous part of the elytra was produced downwards beyond the level of the undersurface of the body (as in the male) but the elytra were conjointly rounded or perhaps somewhat angulated at the apex, not as in the male separately mucronate at the extremity with the suture itself produced as a small spine projecting into the triangular gap between the apices of the elytra. It was superficially so distinct from the male that its connection with it would probably not have suggested itself if I had not taken the two specimens out of similar burrows in the same piece of wood, but the two when placed side by side agreed in many striking characters, having identical antennæ, and sculpture of all parts, together with the somewhat unusual absence of a hooked spine on the front margin of the prothorax, and the very unusual structure of the posterior 4 tarsi and production downwards of the apex of the elytra.

S. Australia; dug out of burrows in wood of a living tree at Petersburg.

XYLOPERTHA VIDUA, sp.nov.

Modice elongata; sat nitida; glabra; picea, antennis palpisque testaceis, pedibus rufescentibus; capite sat elongato longitudinaliter sat crebre strigato, antennis prothorace vix brevioribus; prothorace elytrorum latitudine, quam longiori vix latiori, postice sparsim conspicue subtilius punctulato, antice crebre fortiter granulato-ruguloso, antice ad latera utrinque 3-spinoso (spina antica alteris majori uncinata), basi quam margo anticus fere duplo latiori; elytris creberrime sat fortiter ruguloso-punctulatis, inter sculpturam fortiter rugatis, postice minus abrupte declivibus, parte declivi plana fere circulari, haud perspicue carina circumcincta, apice deorsum producta, sutura antice vix perspicue (in parte declivi sat fortiter) cariniformi; humeris lævibus; tarsis posterioribus 4 gracilibus compressis, supra visis fere capilliformibus: tibiis anticis subtus vix denticulatis.

[Long. $1\frac{3}{5}$, lat. $\frac{3}{5}$ line (vix).

The example before me is clearly, I think, the female of a species closely allied to the preceding. I am departing from my usual practice in founding a description on the female only of an insect that probably presents strong sexual characters, because the present specimen is the only female I possess of this probably new genus, and it is desirable that both sexes should be described. *X. vidua* differs from *X. mystica* in the very much stronger and more rugulose sculpture of the elytra (which appear coarsely shagreened rather than punctured) and in the presence of a strong hooked spine on either side of the front margin of the prothorax above the eye.

The declivous portion of the elytra is nearly as long down the suture as the non-declivous portion; it is inclined at an angle of about 45° to the non-declivous portion, and has a nearly flat or slightly convex surface interrupted only by the carinated suture.

S. Australia; taken near Port Lincoln by beating branches of trees.

TENEBRIONIDÆ.

PTEROHELÆUS RAUCUS, sp.nov.

Latus; opacus; niger; quasi coagulatione tectus; antennis elongatis; lateribus latissime deplanatis; capite sub lente crebre dupliciter punctulato, oculis sat approximatis; prothorace quam in medio longiori fere quater latiori, leviter inæquali, medio longitudinaliter canaliculato, disco crebre subtilius granulato; elytris granulatis, granulis hic illic majoribus in seriebus longitudinalibus dispositis. [Long. 11, lat. 7½ lines.

A remarkably fine and distinct species of the same group as *P. Walkeri*, De Brême, which it resembles in shape, but the extra-discal portion of the prothorax is concave (the lateral margins being bent upward), and of the elytra wider (though much less conspicuously separated from the disc owing to the granulation of the latter being continued uninterruptedly almost to the actual lateral margin). The antennæ set back reach distinctly beyond

the apex of the scutellum. With the exception of some almost obsolete punctures on the head, the entire upper surface is devoid of puncturation even under a strong lens. The granules on the elytra are rather closely set throughout (most so near the suture), and have a general tendency to a linear arrangement, here and there some granules (more or less exceeding the average in size) running in *well defined* longitudinal rows; the most conspicuous of which are one about the middle of the disc (which is quite obsolete near the apex) and another half-way between it and the suture (this latter row being obscurely continued almost to the apex). The extreme margins of prothorax and elytra are a little rufescent. The elytra at the extreme apex are dehiscent and separately end in an obtuse point, but this may not be always the case as they are not quite symmetrical in the example before me.

N. Territory of South Australia; taken by Dr. Bovill.

HELÆUS ELONGATUS, sp.nov.

Parallelus; elongatus; glaber; nitidus; subtus fuscus, supra nigricans, marginibus supra et subtus læte testaceis anguste nigro limbatis; his supra (sub lente forti) minute nec crebre granulatis; prothorace postice tuberculo conico acuto instructo, foramine quam longiori parum latiori; elytrorum disco subseriatim sat fortiter nec crebre punctulato, tuberculorum seriebus septenis instructo, seriebus alternis antice abbreviatis, seriei marginalis tuberculis majoribus subspiniformibus, sutura valde cariniformi.

[Long. 13½, lat 7 lines.

Resembles *H. pallidus*, Macl., (of which I have an example named by its author) but narrower and more parallel. It differs also in the right-hand anterior projection of the prothorax being above the left-hand projection at the apex (I am not at all sure of the value of this character), and in the space enclosed by the anterior projections of the prothorax being scarcely wider than long; the elevation in front of the middle of the base of the prothorax is less spiniform,—resembling a sharp conical tubercle

rather than a spine. The elytra are very differently sculptured, their puncturation being about equally strong but less close and having a tendency to a sublinear arrangement especially behind,—this sublinear puncturation taking the form of longitudinal strips of punctures (the punctures in which are confused *inter se*) separated from each other by longitudinal lævigate or sublævigate strips; the longitudinal rows of small tubercles on the elytra, in the outermost of which the tubercles are replaced by stout little spines, at once distinguish this insect from *H. pallidus*, and the colour is different. This species doubtless also resembles the enigmatical *H. princeps*, Hope, but appears to be considerably smaller and much narrower and more parallel, with the dilated margins of the prothorax and elytra differently sculptured.

It should be noted that the narrow external black edging of the dilated marginal portion is continued along the base of both prothorax and elytra. The bright testaceous colour of the dilated margin, in strong contrast with the black disk and narrow outer edging of black, makes this a very conspicuous species.

Eucla, W. Australia; in the collection of Mr. J. Anderson.

Helæus consularis, Pasc.

Mr. Anderson's collection contains a specimen which I think must appertain to this species; it was taken at Eucla. It is very like *H. moniliferus*, Pasc.,—as *H. consularis* is said to be,—and differs from the former exactly as *consularis* is said to do except in respect of the reflexed margins which according to description should be strong in *consularis* and feeble in *moniliferus*, whereas to me it appears that they are strong (about equally so) in both species. This is certainly puzzling, but I can hardly think it likely that I can have two undescribed species before me both closely allied to *moniliferus* and *consularis*,—and that Sir W. Macleay is also wrong in his identification of the former,—as would appear to be the case if Mr. Pascoe's descriptions are strictly accurate in respect of the reflexed margin. I think it more probable that Mr. Pascoe's description of *H. moniliferus* was founded on an

abnormal specimen. Besides the characters distinguishing *H. consularis* from *H. moniliferus* that Mr. Pascoe mentions, it may be noted that the example of the former before me is more convex than its ally, and has the flattened margin of the elytra narrower and less horizontal while the shoulders of the same are less produced forward.

SARAGUS RUGOSUS, Boisd.

I have lately received from Mr. Duboulay an example (taken in Victoria) of a *Saragus* which seems very likely to be this species. The description is too brief to allow of certain identification, but as the species before me presents the characters mentioned by Boisduval, and does not seem to have been described under any other name, I think Boisduval's name may be assigned to it It is exceedingly closely allied to *S. lævicollis*, Fab., from which it differs as follows:—it is smaller (long. $6\frac{1}{3}$, lat $2\frac{1}{2}$ lines), the costæ and tubercles on the elytra are evidently stronger (the latter being more numerous and more conical), both prothorax and elytra are considerably more widely margined, and the tooth at the external apex of the anterior tibiæ is much smaller.

Of the allied species subsequently described the present insect differs from *S. Odewahni*, Pasc., *catenulatus*, Macl., *rudis*, Macl., *inæqualis*, Blackb., *Lindi*, Blackb., *latus*, Blackb., and *mediocris*, Blackb., by its non-granulate prothorax, the sculpture of that segment being quite as in *S. lævicollis*.

TRICHOSARAGUS, gen. nov.

Sarago affinis, sed differt corpore pilis (supra perlongis erectis, subtus brevioribus minus erectis) densissime vestito; prothorace sat anguste, elytris nullo modo, ad latera dilatatis; mesosterno antice vix concavo; prothoracis tibiarumque anticarum et intermediarum marginibus externis fortiter serratis.

I feel some little uncertainty as to the real affinities of the remarkable insect I am now describing, as I know of nothing to

which it is closely allied. In some respects it would seem to resemble certain *Hopatridæ* (*e.g. Cadius* and *Sobas*), but I think the dense villosity clothing the tarsi beneath, the absence of the clypeal excavation so usual in that group, and the long dense villosity of the general surface, are characters that could hardly combine in a *Hopatrid.* The vestiture is not unlike that of *Ectyche* (though it is considerably longer and more dense) in *Helopidæ*, but many characters (*e.g.*, the head very deeply sunk into the prothorax) at once shows this to be a mere accidental analogy. On the whole I have little doubt that it is to *Saragus* the present insect is really related.

The general form is sub-globular, the length of the whole insect being something less than half again its greatest width, and its height (*i.e.*, distance through the body from centre of metasternum to opposite point on elytra) is nearly half its length,—so that in shape it resembles a *Chrysomelid* (say *Augomela hypochalcea*, Germ.). The mentum is feebly carinated longitudinally. The clypeus is strongly transverse, its free margin continuously reflexed, its anterior outline sub-sinuate. The eyes in repose are quite invisible from above. The antennæ resemble those of *Saragus*. The border of the prothorax is narrowly flattened,—somewhat as in *Nyctozoilus*, but the actual margin is scarcely thickened and is evenly serrate along its whole length. The elytra are soldered together; their margin is quite as feeble as in *Nyctozoilus*. The prosternum between the anterior coxæ is about as wide as in *Saragus*, and arches down behind without any process properly so called, the opposite face of the metasternum being scarcely at all concave. The metasternum is quite short, aud the epipleuræ of the elytra are flat and wide,—even more so than in *Nyctozoilus*. The legs are stout and shortish, the anterior tibiæ terminating in a curved sharp spur about equal in length to the basal four tarsal joints together. The basal joint of the hind tarsi is equal to the following two together and is evidently shorter than the apical joint. The rest of the characters appear to be as in *Saragus*.

T. PILOSELLUS, sp.nov.

Brunneo-testaceus, capite, prothorace, elytrorum costis, pedibusque, rufescentibus; capite prothoraceque subnitidis subtiliter nec crebre punctulatis, sat fortiter sat sparsim granulatis; illo quam longiori duplo latiori, basi quam margo anticus (hoc sat fortiter emarginato) paullo minus duplo latiori, angulis posticis acutis retrorsum directis, lateribus sat fortiter denticulatis; elytris opacis, confertim subtiliter rugulosis, squamis minutis cinereis tectis, singulatim fortiter tricostatis, costis postice abbreviatis, sutura plana nullo modo costata; corpore toto supra pilis perlongis cinereis sat crebre vestito. [Long. 3, lat. $2\frac{1}{5}$ lines.

Yorke's Peninsula, under stones; taken by Mr. J. G. O. Tepper.

AMARYGMUS TARDUS, sp.nov.

Sat brevis; latus; convexus; minus nitidus; supra æneus, obscure cupreo-micans; corpore subtus, pedibus, antennisque nigris, tarsis subtus fulvo-hirtis; capite subtiliter, prothorace elytrisque minus subtiliter sat crebre, punctulatis, his crasse profunde 8-seriatim foveolatis; foveis opacis, subcyaneis anguste cupreo-circumcinctis; prothorace quam longiori paullo plus duplo (postice quam antice paullo minus duplo) latiori, latitudine majori ad basin posita. [Long. $5\frac{1}{5}$-6, lat. $3\frac{1}{5}$-$3\frac{4}{5}$ lines.

The puncturation on the head, prothorax and elytra is somewhat uniform, but becoming gradually a trifle stronger and less close from the head hindward; on the elytra it has no reference whatever to the seriate foveiform impressions, being quite similarly dispersed between the rows of these impressions and between puncture and puncture in each row. The impressions in each row are somewhat irregular in size, the largest however being in the hinder part of the elytra; they are most numerous in the row nearest the suture which contains about twenty-four of them. The elytra have not the faintest indication of striæ; their

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shoulders are quite rounded off. The epipleuræ of the elytra are coloured as the upper surface. The whole undersurface is black with a faint bluish tone and is moderately punctulate with a by no means strong development of longitudinal wrinkles on the lateral portions of the ventral segments. To specify the convexity of the body it may be observed that the height (*i.e.*, the distance from the highest point,—the insect being viewed from the side,—through the body to an opposite point on the surface of the sterna) is to the length of the body as 13 is to 30. The foveæ in the rows on the elytra are much larger than in *A. convexus*, Pasc.

Queensland; taken by Mr. F. M. Bailey on the Bellenden-Ker Ranges.

N.B.—This species has the mandibles bifid at the apex and so would appear to be a true *Amarygmus*. In shape it resembles *A. convexus*, Pasc., which moreover has similar mandibles and therefore must also be reckoned a true *Amarygmus*.

Amarygmus uniformis, sp.nov.

Sat elongatus; minus convexus; sat nitidus; supra obscure viridis, corpore subtus pedibus antennisque nigris; capite prothoraceque crebre subtiliter punctulatis; elytris punctulato-striatis, striis postice gradatim profundioribus, puncturis in striis apicem versus obsoletis; interstitiis subplanis, subtilissime punctulatis; prothorace quam longiori duabus partibus (postice quam antice fere duabus partibus) latiori. [Long. 6, lat. 3 lines.

An elongate-oval species with the shoulders of the elytra well marked, the humeral angle being acute and quite prominent. The punctures in the striæ on the elytra are strong and rather large except near the apex where they are almost obsolete, and close to the base where they are small though deeply impressed; in the 3rd stria there are about 14 punctures from the base to the point where they become very small behind the middle. The sculpture of the underside is very similar to that in *A. tardus* but

the longitudinal wrinkling of the ventral segments is more conspicuous. The "height" of the body (as defined in the description of *A. tardus*) does not exceed a third of the length.

The perfectly unicolorous dark blackish-green colour of the upper surface is quite identical in the three examples before me, and in itself distinguishes this species from any other known to me. The colouring of *A. bicolor*, Fab., must be somewhat similar, but that species is said to be "æneous" on the upper surface; the present species is not at all so. Unless the type can be referred to, *A. bicolor* cannot be positively identified as the description is quite insufficient.

The mandibles are those of an *Amarygmus*, but the facies is entirely of *Chalcopterus*.

Queensland; taken by Mr. F. M. Bailey on the Bellenden-Ker Ranges.

CURCULIONIDÆ.

Poropterus prodigus, Pasc.

There is nothing in the description of this species to distinguish it from *P. (Acalles) conifer*, Er. If the two are distinct (as seems likely enough from the wide divergence of their localities,—Eclipse Island and Tasmania) they must be very closely allied. The description is in both cases fairly detailed; but I can find no point of difference whatever.

LONGICORNES.

Tritocosmia digglesi, Pasc.

This species appears to be identical with *T. atricilla*, Newm., described nine years previously.

PHYTOPHAGA.

Aulacophora australis, Blackb.

I have come to the conclusion that this insect is a variety of *A. analis*, Weber (described from Sumatra). I think the var.

perhaps deserves to be a named one, as it seems to differ from the type in having the tibiæ and tarsi (not black, but) fuscous-brown, the anterior two pairs being at the base scarcely darker than the femora. It is of course possible that if the original type from Sumatra could be referred to other differences might be found.

NEORUPILIA STIRLINGI, sp.nov.

Modice convexa; subnitida; elytrorum ad apicem fortiter dilatata; nigro-viridis, subtus obscurior, capite (hujus parte posteriori, et antennarum articulis ultimis ferme 7, picescentibus exceptis) prothorace, pedibusque, testaceis; capite (hoc inter oculos longitudinaliter profunde breviter sulcato) et prothorace subtilissime sat crebre (nihilominus leviter vix perspicue), elytris confuse sat subtiliter sat crebre subrugulose, punctulatis; corpore subtus minus crebre strigoso-punctulato; metasterno postice et segmento ventrali penultimo (? alterutrius sexus soli) in medio impressis; segmentis dorsalibus ultimis 3 (? alterutrius sexus soli) ab elytris haud tectis. [Long. $1\frac{2}{5}$, lat. $\frac{4}{5}$ line.]

It is probable that I have before me only one sex of this species; unfortunately the half dozen examples have been fastened on cards with some kind of mucilage of so unyielding a character and so plentifully used that they are not easily cleaned for examination, and the one I have cleaned has suffered much damage in the process,—but I think nothing would be gained by similar treatment of the rest as it is probable that the sexes differ in the length of the elytra and in the antennæ, and in these respects I find no difference in the examples before me, which are probably males. The prothorax is by measurement nearly as long as wide (to a casual glance it appears even longer) and is scarcely narrowed in front; its sides are gently rounded. The elytra are twice as wide at the apex as at the base. The antennæ are moderately stout and reach back nearly to the apex of the elytra, their basal joint being elongate (reaching when extended laterally slightly beyond the outline of the eye) and nearly equal to the 2nd and 3rd joints together; the 3rd is twice as long as the 2nd. The metasternum

is evidently (but not much) shorter than the prosternum. Compared with *N. viridis*, Blackb., (Trans. Roy. Soc. S.A., Vol. XI., p. 177), this species is larger and more robust, with the elytra much wider behind, and is coloured quite differently. The claws (as in *N. viridis*) have an obtuse rather large tooth at the base.

Adelaide; taken by E. C. Stirling, Esq., M.D., President of the Royal Society of S. Australia, an accomplished zoologist to whom I dedicate this interesting little species.

COCCINELLIDÆ.

CHILOCORUS BAILEYI, sp.nov.

Hemisphæricus; nitidus; capite, antennis, palpis, corpore subtus, et pedibus, testaceis; prothorace nigro, lateribus late (et margine antico anguste undulatim) rufis; elytris totis nigris; capite prothoraceque leviter sat crebre, scutello elytrisque paullo fortius minus crebre, punctulatis; his ad humeros rotundatis, haud productis. [Long. $2\frac{1}{5}$, lat. 2 lines.

Regarded from the side the upper outline appears as a very strong curve, its highest point being scarcely in front of the middle; at that point the height (*i.e.*, the distance through the body to the surface of the sterna) is $\frac{3}{5}$ of the length of the whole body.

Compared with the European *C. renipustulatus*, Scriba, this insect is more strongly convex, with the shoulders of the elytra much less prominent and the puncturation of the same much stronger.

The only Australian species of *Chilocorus* previously described are *C. Australasiæ*, Kerv., and *rubidus*, Hope. Unfortunately, the description of the former (beyond the statement that it is hemispheric and shining) gives no information whatever except regarding the colour and markings; though these are widely different in the present species I should not venture to treat them

definitely as marking anything more than a variety were it not that I perceive from M. de Kerville's admirable figure of his insect that it has the humeral angles of the elytra much more advanced. The latter (omitted from Mr. Masters' "Cat. of the described Col. of Australia") has the elytra almost entirely red and (if M. Mulsant is right in his statement,—apparently founded on personal inspection of the type,—that it is a var. of *C. tristis*) very differently punctured.

Queensland; a single example was taken by Mr. F. M. Bailey on the Bellenden-Ker ranges.

THE EXAMINATION OF KINOS AS AN AID IN THE DIAGNOSIS OF EUCALYPTS.

PART II.—THE GUMMY GROUP.

By J. H. Maiden, F.L.S., F.C.S.

In Part I. (this Journal, p. 605), I showed that Eucalyptus Kinos entirely soluble in both water and alcohol belong to the Renantheræ, with but one exception. All such Kinos, with certain members of a group yet to be described, satisfy the requirements of the "British Pharmacopœia" in regard to Kino,* and the importation of a single ounce of that drug is unnecessary.

I mentioned in that paper that certain Kinos while readily soluble in water, are very imperfectly soluble in alcohol, owing to the gum they contain. I ventured to call such Kinos the "Gummy" group, which if not elegant is a characteristic designation, as in all other Kinos gum is absent.

Up to the present, I find that the following Eucalyptus Kinos belong to this group:—

1. *E. siderophloia*, Benth.
2. *E. paniculata*, Sm.
3. *E. crebra*, F.v.M.
4. *E. leucoxylon*, F.v.M. (Syn. *E. sideroxylon*, A. Cunn.)
5. *E. resinifera*, Sm.
6. *E. robusta*, Sm.
7. *E. saligna*, Sm.

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* See papers by the author on this subject, *Pharm. Journ.* [3]. xx. 221, 321.

It is interesting to observe that the first four on the list are "Ironbarks,"—a very natural group. In what relation do the other three species stand to this group and to each other? Following is Bentham's classification of the seven species :—

HETEROSTEMONES.................		*leucoxylon.* *paniculata.*
PORANTHERÆ.......................		*siderophloia.*
MICRANTHERÆ......................		*siderophloia.* *crebra.*
NORMALES.	(*Robustæ*)........ (*Subexsertæ*).....	*robusta.* *saligna.* *resinifera.*

In the above classification the Ironbarks are spread over two, or three, series.

In Mueller's anthereal classification the Ironbarks are spread over two groups, while in the same author's cortical system they naturally come together in Schizophloiæ.* Also, in Bentham's classification, *E. resinifera*, *E. robusta* and *E. saligna* come together under the Normales, and likewise under the Baron's Parallelantheræ, but they are separated in the cortical system, *E. saligna* falling under Leiophloiæ, and *E. robusta* and *E. resinifera* under the Rhytiphloiæ.

It is interesting to find that the undoubted affinities of the Ironbarks extend to their Kinos, and that the affinities of *E. robusta*, *E. resinifera*, and *E. saligna* as regards their anthers (especially strong between the latter two), receive collateral proof in regard to their Kinos. The affinities of *E. robusta* and *E. resinifera* are also referred to in Decade VII of Mueller's *Eucalyptographia ; E. punctata* Kino contains no gum (falling in the Turbid group); this emphasises the undoubted difference between *E. resinifera* and that species.

Mem.: *E. robusta*, *E. saligna*, and *E. resinifera* all have red timbers, which is an affinity, shared, however, with other species.

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* The Schizophloiæ is not, however, a *perfect* classification. I have seen bark of *E. stellulata*, for instance, which cannot be distinguished from what are generally known as "Ironbarks."

Much yet remains to be done in regard to the classification of the Eucalypts. We have the anthereal systems of Mueller and Bentham, which have been modified by the former botanist, and the cortical system of Baron Mueller. But unfortunately their usefulness is limited, since they do not sufficiently break down this very large genus. No classification yet suggested is entirely satisfactory, through no fault of their authors. My "Kino system" is an aid in this work of scientific classification, and, as I have worked at all the authentic material I can obtain, I publish it, even in its incomplete state, in order to awaken the interest of botanists in the matter, as the accumulation of the necessary material is beyond the opportunities of one institution or of one individual, even in a life-time. I am sanguine that, by combining the three systems (and perhaps others to be formed), a series of tables to aid in the diagnosis of Eucalypts will in the future be constructed, whose precision will be comparable with that of a chemical table for discriminating the metals.

The great drawback to the classifications hitherto propounded (and I by no means make any extravagant claims for my undeveloped system at this early stage), is that they are not *natural*, that is to say they sometimes bring into juxtaposition plants which have no strong affinities (as far as we know), and the reverse. Bentham (B.Fl. iii. 186) was alive to the value of a natural system, though he felt that the time had not then arrived for making it. "In the meantime," said he, "as far as I can gather from the information supplied, it appears to me that among large trees, the majority of the Stringybarks are to be found in my first series with reniform anthers, and of the Ironbarks and Box-trees in the following three series." . . . I have already fragmentarily alluded to this point.

Characteristic of the Gummy Group.—The one characteristic is the presence of gum, a very simple matter to determine. This

is the group of Kinos to be avoided by the pharmacist, since each member (as far as they have been examined), contains between 30 and 40 per cent of gum. They tend to be perfectly soluble in cold water, and age seems to have comparatively little effect on them in this respect.

The matter of the uselessness of Kinos of this group for the preparation of tinctures is of such importance to every medical man and pharmacist in Australia, that I make no apology for quoting portion of a recent paper by myself in the *Pharm. Journ.* of Great Britain.

"It has been stated that Botany Bay Kino has been procured principally from this species *(E. siderophloia)*. But what are the characteristics of Kino? The official Kino *(Pterocarpus Marsupium)*, is, according to the British Pharmacopœia of 1885, 'almost entirely soluble in rectified spirit.' This is an important property, and on it the Tinct. Kino B.P. is based. Works on Materia Medica, while pointing out certain unimportant points of dissimilarity between the official and Eucalyptus Kino, never state that the latter does not dissolve in rectified spirit, while some make the specific statement that it is soluble in that liquid. But my experiments have shown that no Kino is more insoluble in spirti than that of *E. siderophloia!* . . . The Kino of *E. resinifera*, Smith, is also comparatively little soluble in spirit, for a similar reason. For this reason alone, I do not hesitate to say that 'Botany Bay Kino' is neither the produce of *E. siderophloia*, Benth., (*E. resinifera*, Smith), nor *E. resinifera*, A. Cunn. Both these Kinos would be quite useless for the preparation of the tincture, and would never be thought of a second time by any person who had made the experiment on either: it is therefore quite certain that these species have not caused pharmacists to use Eucalyptus Kinos more or less for a century, but rather, it has doubtless been the admixture of such Kinos as these with such Eucalyptus Kinos as are freely soluble in spirit, which has helped to bring Eucalyptus Kino into disrepute."

When the Ironbark Kinos are of the same age, I doubt whether they can be distinguished from each other. They darken with age, like other Kinos, colour being with Kinos often simply comparative. They are bright looking, and often with an almost greasy lustre, are obtainable in large pieces, for their tenacity is such (owing to the gum they contain), that they do not easily break into small pieces like the Ruby Kinos,—much less do they break into powder like the members of the Turbid Group. They stick to the teeth if chewed.

Following is a detailed account of such of the "Gummy" Kinos as have fallen into my hands, up to the present. I reserve the publication of an exhaustive analysis of a typical Kino of each of the groups for another occasion.

In the case of *E. siderophloia*, I have described several Kinos of different ages, the object being (as in the Ruby Group), to show the variability in appearance, and the range of variability of composition.

EUCALYPTUS CREBRA, F.v.M., B.Fl. iii. 221.

"Narrow-leaved Ironbark," though, as Dr. Woolls has pointed out, there is a narrow-leaved form of *E. paniculata*, for which this species may be mistaken. Extends from N. S. Wales to Northern Australia.

No. 25. I am indebted to Mr. R. T. Baker for this sample; he obtained it 7th Oct. 1889, at St. Mary's, South Creek, N. S. Wales.

It cannot be distinguished in outward appearance from that of *E. siderophloia* (No. 31) below.

EUCALYPTUS LEUCOXYLON, F.v.M. (Syn. *E. sideroxylon*, A. Cunn. B.Fl. iii. 209.)

Found in N. S. Wales and Queensland.

Dr. Wiesner (*loc. cit.*), says of this Kino, "Same reaction as *E. globulus*.* Large black-red lumps, with fibrous impurities."

* I have not yet been able to obtain Kino of this species, so I am unable to criticise the comparison.

Sometimes the bark of this tree is honeycombed, the cavities being filled with Kino. The blackish Kino, set in rows, in the light reddish-brown bark, has a beaded granular appearance, characteristic, perhaps, of this species.

No. 26. "Ironbark." Received from the Botanic Gardens, Sydney, 29th December, 1887.

This sample is in large masses, from which the firmly adherent wood and bark have to be cut away. It is of horny appearance, and shows something of that texture when cut with a knife. It is opaque-looking, except at fresh fractures. The Kino appears almost black, and it is only at the edges of thin splinters that it is observed to be of a deep garnet colour. It powders with difficulty, forming a powder much like Indian red.

Cold water yields a deep orange-brown solution, leaving a residue consisting of phlobaphene and shavings of bark. The process of solution goes on very slowly. Colour of residue Sienna brown.

EUCALYPTUS PANICULATA, *Sm.*, B.Fl. iii. 211-212.

Found in N. S. Wales, the S. Australian and Victorian species being probably different.

No. 27. "She Ironbark;" North Ryde, 28th April, 1888. Diam. 1 ft. 6 in.; height, 60 ft.

The tree which yielded this particular sample yielded it in unusual abundance. Not only have I never seen a tree of this species yield it in such quantity, but in abundance it rivalled the quantity exuded by an *E. corymbosa* tree in full bearing of Kino. The rugged bark was covered with a mass of long tears, and samples of great purity could readily be obtained. When collected, this Kino resembled orange lac in appearance to a marked degree, though some fragments varied in tint to brown and garnet lac. In all cases the resinous appearance of the Kino is strikingly similar to lac. It is fairly brittle, and forms a bright powder.

It dissolves readily in cold water, forming a very pale-coloured solution of an orange-brown colour. Colour of residue Vandyke brown.

EUCALYPTUS RESINIFERA, Smith, B.Fl. iii. 245.

Found in N. S. Wales and Queensland.

"The specific gravity of this Kino is about 1·416 and the percentage of tannin 65·57 (*sic*)" (Staiger).

Dr. Joseph Bancroft quotes another analysis by Mr. Staiger of this Kino, in which he found 54 per cent. of Kino-tannic acid, and "also a kind of gum-arabic, but in older samples the amount of Kino-tannic acid is greater, and the gum less." I have no particulars of the above Kinos, so I am unable to say how far Mr. Staiger's analyses and my own are reconcileable.

In the Catalogue of the Museum of the Pharmaceutical Society of Great Britain (p. 46), a Kino called *E. resinifera*, Lin. (a misprint probably for Cunn., and therefore the species would be *E. siderophloia*), is catalogued, and the statement is made that "This gum may be recognized by its reddish tint and powdery surface." Neither of the Kinos of the two *E. resiniferas* answers to this description; such a Kino would probably be allied to *E. rostrata* (a member of the Turbid group).

No. 28. "Mahogany." Received from the Government Botanist of Queensland (Mr. F. M. Bailey), February, 1888.

In smallish tears for the most part, showing firmly adherent wood or bark on one side. A clear-looking Kino of a dark colour, showing a dark ruby colour by transmitted light. It has evidently been collected for a long time. It is inclined to be tough and horny, and is therefore rather difficult to powder. Fracture bright. Colour of powder of a pure burnt Sienna.

Cold water forms a deep orange-brown coloured liquid, which thins out to a bright orange-brown colour. Colour of residue Vandyke brown.

With alcohol (so as to form a tincture of B.P. tinct. Kino strength), the supernatant liquid is of a reddish-brown colour, and the granular residue is of a reddish-brown colour likewise.

EUCALYPTUS ROBUSTA, Smith, B.Fl. iii. 228.

Found in N. S. Wales and Queensland.

Note.—Smith, in describing this species in his *Specimen of the Botany of New South Wales*, 1793, styled it the "Brown Gum-tree" or "New Holland Mahogany." The first name was given because "its resin is an inferior sort of red gum, of a brown hue." Smith's Kino was brownish because it was old, and I draw attention to the name "Brown Gum," which is sometimes quoted in connection with this species, in order to point out that it is never employed in Australia, and was simply Smith's appellation.

No. 29. "Swamp Mahogany." Bolong Swamp, Nowra, August 1888. Diam., 1-5 ft.; height, 60-100 ft. A poor sample. In tears with adherent fibrous bark. The tears are quite bright, and therefore freshly exuded, presumably. It is of a more than ordinarily rich deep ruby colour.

Cold water yields a solution of a medium orange-brown colour, and leaves a reddish-brown residue. With alcohol (tinct. B.P. strength), the liquid is but slightly coloured; the granular gummy residue is rendered opaque-looking, and of tints from flesh colour (gum), to Vandyke brown (phlobaphenes).

EUCALYPTUS SALIGNA, Smith, B.Fl. iii. 245.

Found in N. S. Wales and Queensland.

No. 30. "Blue Gum." Eastwood, near Sydney, 28th April, 1888. Height, 80 ft.; diam., 3 ft.

A dullish-looking Kino, of all tints of garnet. It is of a horny texture for the most part. In bulk it perhaps most generally resembles *E. punctata* Kino in appearance, but it has none of the brown tint of the latter.

It readily dissolves in cold water, forming a quite clear liquid of a dark orange-brown colour, with a small amount of residue of a Vandyke brown colour. Alcohol (B.P. strength of tincture) yields a reddish-brown liquid, and leaves a granular residue of a dark reddish-brown colour.

EUCALYPTUS SIDEROPHLOIA, Benth. (Syn. *E. resinifera,* A. Cunn., *non* Smith), B.Fl. iii. 220.

Found in N. S. Wales and Queensland.

"The specific gravity of this Kino is about 1·413, and the percentage of tannic 72·13" (Staiger). I regret that I cannot accept this percentage of tannic acid.

Dr. Joseph Bancroft of Brisbane describes this Kino as exuding plentifully, and at first being in long tears of a pale yellowish colour, which darken into bright red, and eventually into black, becoming more insoluble. (I can endorse this description from examination of New South Wales specimens). He states that a tincture made with 2½ ounces to a pint of proof spirit is valuable as an astringent in diarrhœa, but gelatinizes on keeping. I have already pointed out that Kino of this species is little soluble in spirit owing to the gum it contains.

No. 31. "Ironbark." Cambewarra, 12th August, 1886. Height, 80-100 ft.; diam., 4 ft.

Obviously newer than the two succeeding Kinos. It is of a rich ruby colour, both by reflected and transmitted light. It is mostly in tears, rather horny, and therefore difficult to powder. Colour of powder Sienna brown.

It dissolves in cold water almost entirely, forming a medium orange-brown liquid. The residue consists of reddish phlobaphene, with a trace of accidental impurity. Colour of residue umber brown. With alcohol (strength of B.P. tinct. Kino), a pale sherry-coloured liquid is formed. The insoluble residue collects into rounded pieces, swells up slightly, and does not disintegrate with

shaking the bottle. It reminds one irresistibly of potted lobster. When rubbed gently with a glass rod the lumps disintegrate, and the interior of them is found to be of a salmon colour. On evaporation of the spirit the masses shrink in bulk, become of a darker colour (though far lighter than the original Kino), and extremely brittle.

No. 32. "Broad-leaved or Red Ironbark." Richmond, N. S Wales, July, 1886. Given to me by the Rev. Dr. Woolls.

In masses of a pure reddish-brown to ruby, and almost transparent. Woody matter is finely adherent to the outside of the masses. Rather difficult to powder as it feels gummy.

With cold water and alcohol it behaves in exactly the same way and possesses the same appearance as the preceding specimen. Colour of residue umber brown.

No. 33. "Ironbark." Queensland. Received from Mr. F. M. Bailey, Government Botanist of that colony, February 1888.

This sample must have been collected for a considerable period. It is black and dull looking, and quite horny in texture. The ruby colour is apparent if very thin splints be taken. Some wood or bark is firmly adherent. It is exceedingly difficult to powder. Colour of powder dark Sienna brown.

With cold water the solution is much darker than that with the other samples of this species. It is of a deep orange-brown colour. Colour of residue brown to Vandyke brown. Alcohol appears to have but little effect on this Kino.

No. 34. "Ironbark." Cambewarra, 25th September, 1888. Height, 60-80 ft.; diam., 2 ft.

A quite freshly exuded Kino. It is of a pale orange colour, and in tears of considerable size. Fracture dull resinous; gummy to the feel. The description of *E. paniculata* (Ryde), applies to this sample.

Cold water yields a very pale orange-brown solution, with a rose tint. Alcohol (B.P. strength of tincture), yields an almost colourless solution. The gummy granular residue is flesh-coloured.

GUMMY GROUP.

Percentage of the following Constituents.

No.	Name.	Kino-tannic Acid.	Insoluble Phlobaphenes.	Gum.	Ash.
25	*Eucalyptus crebra*, F.v.M.	37·99	trace	40·42	·2
26	*E. leucoxylon*, F.v.M.	32·51	5·1	34·2	·1
27	*E. paniculata*, Sm.	34·74	2·9	34·9	·2
28	*E. resinifera*, Sm.	39·62	2·0	32·1	·1
29	*E. robusta*, Sm.	35·05	3·7	31·4	·2
30	*E. saligna*, Sm.	35·56	4·6	31·3	·2
31	*E. siderophloia*, Benth.	36·07	1·6	33·7	·1
32	Ditto	35·1	1·2	38·1	·1
33	Ditto	33·02	2·2	39·0	·4
34	Ditto	37·08	trace	34·1	·1

STUDIES IN AUSTRALIAN ENTOMOLOGY.

NO. II.—SIX NEW SPECIES OF CARABIDÆ.

By Thomas G. Sloane.

I lately received from Mr. C. French, Government Entomologist of Victoria, six species of Carabidæ belonging to the tribe Carenides; of these four came from the Fowler's Bay district of South Australia, two being new species, which I have named *Carenum vicinum*, and *C. lepidum;* the other two are *C. rugatum*, Blackburn, and *C. (Chariscapterus) opulens*, Sloane; of the latter there are two specimens, one of which has the elytra of a beautiful coppery purple. The two remaining species are from the McDonnell Ranges, in the centre of the continent, and are a new species of *Euryscaphus (E. titanus)*, and a new *Carenum (C. habitans)* very distinct from anything I have previously seen.

Euryscaphus titanus, n.sp.

Black, shining. Head large, subquadrate ($9\frac{1}{2} \times 12\frac{1}{4}$* mm.); thick and heavy, the frontal sulci short, connected behind by a faint curved impression, parallel towards the front, then turning outwards in a broad curve; clypeus sloping backward from the labrum, with the usual setigerous puncture on each side in front of the out-turned frontal sulci; mandibles large, smooth towards the apex, transversely striate on the large internal teeth; eyes prominent, a short blunt tooth-like process projecting forwards and downwards below them; mentum short, lobes rounded externally to the inner point, the inner side almost square, the median tooth broad, triangular, keeled, with broad reflexed margins (epilobes), two deep foveæ on each side of the base

* This is the width without the eyes; the same remark applies to the measurements of the head in the other species described in this paper.

of the median tooth; labrum as usual in the genus. Antennæ as usual in the genus, strong, filiform, last article fusiform Prothorax transversely subcordate (10 × 17 mm.), convex, almost parallel on the sides, broadly lobed behind, the anterior margin sinuate; the marginal border strongly reflexed, crenulate on the edge, flattened and roundly advanced at the anterior angles, very wide and vertical at the posterior angles, behind these thickened and but slightly upturned, more prominent on each side of the basal lobe than along the sinuosities before the lobe; the lobe rounded and margined; along the anterior margin a space of about 1½ mm. marked with closely placed longitudinal striolæ; the median line distinctly marked, extending from the rugose part in front to the basal margin; the surface covered with minute scratches, these more apparent towards the sides, thus rendering the lateral parts less shiny than the disc; a lightly marked transverse line across the median line near the base, but the basal part of the prothorax not distinctly defined; two marginal punctures on each side, the basal one being behind the posterior angles. Elytra longer than broad (23 × 20 mm.), very convex, widest at about half the length, rounded on the sides, considerably narrowed to the humeral angles—these well marked and upturned (between them 13½ mm.)—smooth (except for rows of fine punctures visible with a lens*), the base lightly and

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* In regard to the rows of shallow punctures often noticed on the elytra in specimens of various species of the *Carenides*, I now attach no value to this feature for determining species. I have never taken any *Carenid* which showed these traces of puncturation on the elytra when captured; but observations made with specimens of *Carenum arenarium*, Sloane, *C. scaritioides*, Westw., *Eutoma loddonense*, Casteln., and *Carenidium lacustre*, Macl., have showed me that the result of a lengthened immersion in methylated spirits of wine is to bring out rows of punctures on the elytra of all these species, though naturally they are quite smooth. Specimens of these species which I kept for some months in spirits, on being taken out, all showed rows of shallow punctures on the elytra. Unfortunately, since noticing this I have never had any opportunity of collecting specimens of *Carenum* to further experiment with. Of course these remarks do not apply to *Laccopterum* or *Epilectus*. The same results happen in the genus *Promecoderus*.

broadly emarginate, with a single oblique row of punctures on each elytron; the lateral margins broad, lightly reflexed on the anterior half, but the upturned edge disappearing towards the apex; a row of fine punctures along the sides, these more closely placed on the anterior half. The anterior tibiæ with two very strong external teeth, above which the exterior ridge has four tooth-like projections visible from above, the inferior ridge is closely serrate extending past the upper external tooth, the apical plate projects in a short tooth below the tarsus; the intermediate tibiæ strong with a short acute tooth projecting outwards at the apex.

Length 49, breadth 20 mm.

Hab.—McDonnell Ranges, Central Australia.

In size this species almost equals *E. Waterhousii*, Macl., from which it differs in its more elongate elytra, not bulged on the side as in that species, and not nearly so deeply excavate at the base.

A single specimen (♀).

Carenum (Calliscapterus) habitans, n.sp.

Shining, elytra green, head, disc of prothorax, abdomen, and legs black, the prothorax widely margined with green, the under surface of the prothorax towards the sides, and the inflexed margins of the elytra also green. Head large, subquadrate ($5 \times 7\frac{1}{4}$ mm.), frontal sulci deep, converging in front, and turning sharply out in a linear form to the outer base of the mandibles, a deeply marked puncture on each side in front of their course behind the lateral teeth of the clypeus; the occiput marked with fine scratches; one supra-orbital puncture on each side. Prothorax very transverse, broader than the elytra* ($6\frac{1}{2} \times 10\frac{1}{2}$ mm.), rather convex, declivous behind, parallel on the sides, a little narrowed to the anterior angles, these wide, rounded

* The breadth of the prothorax as compared to the elytra varies in some species of *Carenum* (for instance, *Calliscapterus campestre*, Macl.); this difference I believe to be a sexual character.

and produced; the posterior angles rounded off; the base lobate and rounded; the marginal border wide and reflexed, widest at the posterior angles, continuous on the base; the median line light, ending behind in an arched transverse line, between the sinuosities on each side of the base, defining the basal part of the prothorax; a short longitudinal impression extending forward from each side of the basal lobe; the posterior declivous part of the prothorax transversely striolate; two marginal punctures on each side. Elytra oval (14 × 10 mm.), convex, marked with seven rows of distinct shallow punctures* and two discoidal punctures towards the apex, lightly rounded on the sides, and equally rounded in front and behind; the humeral angles prominent and upturned, the base emarginate between them, steeply declivous to the peduncle and marked with a double row of umbilicate punctures on each elytron, a row of evenly placed umbilicate punctures along the margins, every alternate one being larger; the lateral margins broad, especially towards the apex. Prosternum lightly excavate between the coxæ. The legs strong, the intermediate and posterior tibiæ thick and ciliate as in *C. odewahni*, only heavier; the anterior tibiæ tridentate externally, the exterior ridge with four projections above the large teeth, the inferior ridge strongly serrate to the apex of the tibiæ, the apical plate with a short tooth at the apex.

Length 29, breadth 10½ mm.

Hab.—McDonnell Ranges, Central Australia.

A very distinct species; its affinity is to *Carenum* (*Calliscapterus*) *odewahni*, Casteln., but it differs *inter alia* in its elytra not being narrowed to the base, and in having only two, instead of three, prothoracic marginal punctures.

Carenum lepidum, n.sp.

Smooth, shining; elytra iridescent with the disc a deep blackish-purple changing to blue or green on the sides, the

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* See note at page 1289.

lateral margins (and inflexed underpart of elytra) of a bright copper colour, prothorax having the disc deep black with wide fiery copper margins, head and underparts shining black. Head subquadrate ($2\frac{1}{2} \times 2\frac{3}{4}$ mm.); the frontal sulci almost parallel, a little wider behind; the lateral teeth of the clypeus very prominent, a deeply impressed puncture behind them on each side; the preocular processes prominent; the eyes hardly projecting beyond the sides of the head; one supra-orbital puncture above each eye. Prothorax transverse ($3\frac{1}{2} \times 5$ mm.), rather convex, truncate in front between the anterior angles—these a little advanced—, very lightly rounded on the sides, broadest just before the posterior angles; the marginal border wide, reflexed, widest at the posterior angles, sinuate on each side between the posterior angles and the base; the base shortly lobate, very lightly emarginate; the median line finely impressed, not reaching the border behind; the basal part of the prothorax not crossed or defined by a transverse line; two marginal punctures on each side. Elytra lævigate, elongate, very little wider than the prothorax ($9 \times 5\frac{1}{2}$ mm.), convex, with two discoidal punctures towards the apex; the sides subparallel, widest at about half the length, a little narrowed to the base, the base truncate, the humeral angles strongly marked and upturned; the lateral margins not wide, within them a row of closely set punctures. Prosternum hardly impressed between the coxæ, and obliquely narrowed behind. Anterior tibiæ tridentate; the exterior ridge with two projections above the large teeth, inferior ridge consisting of five short projections, the apical plate toothed at the apex; intermediate tibiæ strongly serrate, and with an acute spine at the apex externally.

Length 16, breadth $5\frac{1}{2}$ mm.

Hab.—Fowler's Bay district.

A very distinct species; its affinity is evidently to *Carenum* (*Chariscapterus*) *opulens*, Sloane, but it is very different in its parallel and elongate form. The "inferior ridge" of the anterior tibiæ with strong tooth-like projections, is of a different form to

what I have seen in any Carenid before. Two specimens; one shows a single strong puncture on the declivous part of the base of each elytron, the other has no punctures on the base.

Carenum vicinum, n.sp.

Elytra of a dark blue, almost black in the middle, but becoming a fine purple towards the sides, the margins cæruleous, the prothorax black with a violet margin, head, legs, and underparts of prothorax and abdomen black. Head subquadrate ($4\frac{1}{2} \times 5\frac{3}{4}$ mm.); frontal sulci almost parallel, a little sinuate, diverging in front as usual, an obsolete transverse impression behind them; the preocular processes prominent; the eyes not prominent, one supra-orbital puncture above each eye. Prothorax transverse ($5\frac{1}{4} \times 8$ mm.), rather convex, broadest at the posterior angles, rounded and a little narrowed to the anterior angles, these very slightly produced; the posterior angles rounded off; the margin sharply sinuate on each side of the base, thus giving it a shortly lobate appearance; the lobe very gently rounded and emarginate in the middle; the marginal border wide, sinuate behind, and widened to form a conspicuous angle on each side of the basal lobe; the median line lightly impressed, its course crossed by very fine transverse striolæ; the basal part of the prothorax not defined by a transverse line; only two marginal punctures discernible on each side, one near the anterior angle, the other at the posterior angle. Elytra lævigate, ovate, a very little broader than the prothorax ($11\frac{1}{2} \times 8\frac{1}{4}$ mm.), gently rounded on the sides, very slightly narrowed to the base; the humeral angles well marked and upturned, the base truncate and steeply declivous between them; the marginal border narrow and reflexed, a row of fine punctures within it; on each elytron a large discoidal puncture towards the apex, and a few punctures in a single row on the base. Anterior tibiæ bidentate externally, the exterior ridge with four projections above the large teeth, inferior ridge serrate, reaching the apex of the tibiæ, the apical plate with a sharp projecting spur at the apex.

Length 24, breadth $8\frac{1}{4}$ mm.

Hab.—Fowler's Bay district.

A single specimen. This species is very closely allied to *C. planipenne*, Macl., but differs in its colour showing no trace of green; in the shape of the elytra, which are not so flat, and also differ in not being emarginate and gently declivous between the shoulders, and in being much narrower and more sharply rounded behind. The shape of the prothorax is the same in both species, though a little more convex in *C. vicinum*; I can find no trace of more than two marginal punctures on each side, while in *C. planipenne* there are three; *C. vicinum* has only one supra-orbital puncture on each side of the head while *C. planipenne* has two.

NOTONOMUS ARTHURI, n.sp.

♀. Elytra of a metallic green or purple, head, prothorax, and underparts black. Head smooth, with the frontal impressions well marked; a light transverse impression on each side behind the posterior supra-orbital puncture; the eyes prominent, inclosed behind. Prothorax a little broader than long ($4\frac{3}{4} \times 5\frac{1}{2}$ mm.)—in one specimen the measurements almost equal—slightly rounded on the sides and a little narrowed to the base; the posterior angles rounded; the base widely and very slightly emarginate between the lateral impressions, these narrow and reaching the basal margin; the marginal border reaching behind the lateral impressions on each side of the base; the posterior marginal punctures placed before the angles of the base, and inside the marginal border; the median line distinct, not reaching either margin. Elytra oval (12×7 mm.), not convex, a little narrower to the base, rounded on the sides, broadest at about half the length, sinuate behind, dehiscent at the apex, striate; the interstices flat (9th stria and interstice as usual), 3rd with three impressed punctures; the border of the base almost straight; the humeral angles not marked. The segments of the abdomen smooth as usual The prosternum not excavate between the coxæ.

Length 20, breadth 7 mm.

Hab.—Mt. Wilson, Blue Mountains, N.S.W.

This species comes near *N. variicollis*, Chaud., but has the basal angles of the prothorax more rounded. Three specimens, all ♀, taken by Mr. A. Sidney Olliff (to whom I have dedicated it) at Mt. Wilson. The type is in the Australian Museum.

Notonomus lateralis, n.sp.

♂. Black, shining. Head smooth, rather broad; clypeus with a setigerous puncture on each side, the clypeal suture distinct, ending on each side in the frontal impressions, these lightly marked and linear; eyes not prominent, inclosed behind; the vertex hardly at all transversely impressed behind the posterior supra-orbital puncture. Prothorax subquadrate, slightly broader than long ($4\frac{1}{4} \times 5$ mm.), lightly rounded on the sides, hardly at all narrowed to the base, the posterior angles rounded off; the base widely emarginate between the lateral impressions, these short and not reaching the basal margin; the marginal border reflexed on the sides, reaching as far as the inner side of the lateral impressions on each side of the base; the posterior marginal punctures in the lateral border at the basal angles. Elytra parallel (10×6 mm.), truncate at the base, rather flat on the disc, the sides and apex declivous, broadly rounded and hardly at all sinuate behind, dehiscent at the apex, strongly striate, the 9th stria very wide and hardly bifurcate behind, the abbreviated stria short and oblique; the interstices convex towards the apex, 2nd, 4th, and 6th narrowed behind, 9th marked throughout its course by umbilicate punctures, these closer (but not confluent) towards the apex, 3rd of each elytron with three punctures (all on the posterior half), of these two deeply impressed on the declivous part near the apex, the other four forming a square just behind the middle of the elytra; the lateral margin wide, the border being more decided behind; the border of the base is arched, not toothed though slightly raised at the humeral angles. The three last segments of the abdomen

with a deep transverse impression on each side. The posterior tarsi with the articles shorter and thicker than usual in the genus.

♀.—Having the elytra completely flattened on the hinder part of the disc, and almost vertical on the sides and apex; the wide smooth space within the marginal border (representing the 9th stria) wider than in the ♂.

Length ♂ 17½, breadth 6 mm.

Hab.—Mt. Wilson, Blue Mountains, N.S.W.

A very distinct species differing from all other species of *Notonomus* I have seen in having distinct and deep lateral impressions on the segments of the abdomen, and in the wide smooth space within the marginal border of the elytra; also in the flattened elytra with vertical sides and apex in the ♀.

Three specimens taken by Mr. A. Sidney Olliff.

NOTES ON THE NIDIFICATION OF *MERULA VINITINCTA*, GLD., AND *OCYDROMUS SYLVESTRIS*, SCL.*

By A. J. North, F.L.S.

NOTES ON THE BREEDING OF *STERNULA SINENSIS*, GMEL., IN AUSTRALIA.*

By A. J. North, F.L.S.

DESCRIPTION OF A NEW AUSTRALIAN SKINK.*

By E. P. Ramsay, L.L.D., F.R.S.E., and J. Douglas Ogilby, F.L.S.

DESCRIPTIONS OF TWO NEW SKINKS.*

By J. Douglas Ogilby, F.L.S.

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* *Note.*—The four papers read under the above titles have already been published in the *Records of the Australian Museum*, Vol. I. No. 1 (March, 1890).

NOTES AND EXHIBITS.

Mr. Maiden exhibited samples of the kinos referred to in his paper.

Mr. Ogilby exhibited the three lizards described above.

Mr. North sent for exhibition the nest and eggs of *Merula vinitincta*, the eggs of *Ocydromus sylvestris*, and skins and eggs of *Sternula sinensis*.

Mr. Sloane exhibited the insects described in his paper.

Mr. Rohu exhibited the upper jaw of a Death Adder (*Acanthophis antarctica*) in which on one side there is an equally developed supplementary tooth placed on the transverse plane.

Mr. A. Sidney Olliff sent for exhibition three specimens (two ♂ and one ♀) of *Atyphella lychnus*, Oll., together with the following note on the discovery of the female of that species:—

"In answer to an appeal for information about the sexes of the Fire-fly recently described in the Proceedings of this Society (see *antea* p. 645), under the name *Atyphella lychnus*, Mr. James D. Cox has forwarded to me ♂ and ♀ examples which he found *in copula* at Mount Wilson early in the present month. An examination of these specimens enables me to state that *Atyphella* belongs to the division of the family Lampyridæ in which both sexes are winged, and that it is allied to *Lucidota* and *Photinus* of the tribe Lucidotina, a fact which I hardly anticipated from the general form and structure of the male insect. The female has the head and eyes much smaller than the male, and is altogether broader in form, and the underside does not present

distinct light-organs, the entire body—in the single specimen before me—being yellowish-white. In communicating to me his discovery of the female *Atyphella*, Mr. Cox remarks that he did not observe the specimen to be luminous, an observation of the greatest interest and importance, as it goes to support the idea that the females rarely fly in company with the males, but remain concealed in the grass or herbage like the European *Luciola* already alluded to. At all events the absence of luminosity in the female *Atyphella* would account for its having escaped the notice of the collector."

ANNUAL GENERAL MEETING

29TH JANUARY, 1890.

PRESIDENT'S ADDRESS.

AT the close of 1889, the fifteenth year of our Society's existence, I have once more the honour of laying before you the annual report upon the progress and state of the Society, its gains and losses, and the work which it has achieved. In connection with the latter topic, I shall, as heretofore, make reference to such other contributions to the Natural History of Australia as I have been able to observe during the past year.

The first Monthly Meeting of the Society was held on 25th January, 1875, under the presidency of Mr. (now Sir William) Macleay,—who also, at the first Annual General Meeting, 31st January, 1876, delivered the first President's Address. In the meanwhile the "Chevert" expedition had been organised and equipped, and had completed its explorations in and about New Guinea. I have on a previous occasion made the remark that it was unquestionably to that expedition and its results that this Society owes its early and vigorous growth. Nevertheless the remark will bear repeating, as well as the reminder that the whole cost of that expedition was borne by our then President, a point which should not be forgotten in the enumeration of his services to Natural History, and his extraordinary contributions towards the welfare of the Linnean Society of New South Wales.

The number of original members was 125, many of whom there is reason to suppose subscribed not altogether on account of particular interest in any branch of Natural History, but rather in order to give a kindly help to an infant Society, whose objects everyone approved.

At any rate, there remain now, out of these 125, only 24 actual members of the Society, and it seems not unsuitable to our present time of assembling to record the names of the veterans:—

BRADLEY, H. H. BURTON.

BRAZIER, J., F.L.S.

COX, J. C., M.D., F.L.S., President Fisheries Commission.

DODDS, Hon. A., M.L.C.

ELDRED, W. H., Consul for Chili.

HAY, Hon. Sir J., K.C.M.G., &c., President, Legislative Council.

JENNINGS, Hon. Sir P. A., K.C.M.G., &c., M.L.C.

KING, Hon. P. G., M.L.C.

LIVERSIDGE, A., M.A., F.R.S., Professor of Chemistry, Sydney University.

LARK, F. B.

MACLAURIN, H. N., M.D., &c., Medical Adviser to the Government.

MACLEAY, The Hon. Sir WILLIAM, Kt., M.L.C.

MASTERS, G., Curator, Macleay Museum, Sydney University.

MACINTOSH, J. N.

MEREWETHER, E. C.

MAKINSON, H. M.

NORTON, Hon. J., M.L.C.

OSBORNE, G.

RAMSAY, E. P., LL.D., Curator, Australian Museum.

READ, R. B., M.R.C.S.

STEPHENS, W. J., M.A., F.G.S., Professor of Natural History, Sydney University.

WARD, W. D., M.A., M.D.

WILKINSON, C. S., F.G.S., Government Geologist.

WALKER, R. C., Principal Librarian, Free Public Library.

At the present moment the Society numbers one hundred and seventy-one members, five having withdrawn, by resignation or otherwise, and three new members having been elected since the last annual meeting.

But the Society has suffered a very severe loss in the death of one of its most distinguished members, eminent for his attainments, admirable for his union of patience and energy, and everywhere beloved for the unaffected simplicity, courtesy, and kindness which so remarkably characterised his intercourse with others. The Rev. JULIAN EDMUND TENISON-WOODS, who deceased in Sydney on Monday, the seventh of last October, became first attached to this Society upon his election by the Council to the status of a Corresponding Member, in June, 1876. He subsequently became, November, 1878, an ordinary member, and was elected President at the next annual meeting. After holding this office for the customary period of two years, he was elected Vice-President at the commencement of 1883, in which office he continued until the time of his death.

In the list of contributors to the First Series of our Proceedings (published by the Society, 1887), no less than seventy entries testify to the exuberant industry, no less than to the extraordinary variety of attainments, which characterised our lamented friend. They relate to so many different branches of Natural History that it would be impossible to classify them within the limits which the nature of my present duty prescribes.

I therefore simply enumerate them in the order of their appearance, as follows:—

P.L.S.N.S.W., 1st Series, VOL. I.: Observations on the genus *Risella*. VOL. II.: On some Australian sp. of *Trochocochlea*; On a new sp. of *Neæra*; On a variety of *Trigonia Lamarckii*; On a Tertiary Formation at New Guinea; The Echini of Australia, including those of the "Chevert" Expedition, (pp. 31); On some Australian Shells described by Dr. A. Gould; Description of some new Marine Shells (Port Jackson Heads); On some

Tertiary Fossils from New Guinea; On the Extra-tropical Corals of Australia; On the Echini of Australia, supplemental note. VOL. III.: On an Australian variety of *Neritina pulligera*, Linn.; On *Arachnopora*, new genus of Milleporidæ; On *Psammoseris*, new species; On *Desmophyllum*, new species, and young of *Cycloseris Sinensis;* On some Australian Littorinidæ; On *Bulimus Dufresnii;* On three new genera (*Vasillum, Diechorœa, Phyllopora*) and one new species of Madreporaria; On two new species Land Shells; On *Euctimenaria*, new genus of Cheilostomatous Polyzoa; On some Corals from Darnley Island; On some new extra-tropical Corals; On some Freshwater Shells from New Zealand; On some Tertiary Fossils from Muddy Creek, Victoria. VOL. IV.: Continuation of last paper; On some new Marine Shells; On some Freshwater Shells from New Guinea; On some new Marine Shells from Moreton Bay; On *Arauja albens;* On the relations of the Brisbane Flora; On some new Australian Echini; On *Heteropsammia Michelinii*, E. and H.; On *Distichopora*, new species; On *Euctimenaria ducalis;* On some Fossils from Levuka, Viti; On some Post-tertiary Fossils from New Caledonia. VOL. V.: On some of the littoral Marine Fauna of North-east Australia; On a Fossiliferous Bed at the mouth of the Endeavour River; On the habits of some Australian Echini; Résumé of a report on the Fossil Radiata of New Zealand; On *Flabellum*, new species; On *Diaseris*, new species; On a young *Temnopleurus*. VOL. VII.: Botanical notes on Queensland, No. 1; On *Stomopneustes*, new species, and a new variety of *Hipponoe variegata;* On various deposits of Fossil Plants in Queensland; Botanical notes on Queensland, No. 2; On *Allopora*, new species; Botanical notes on Queensland, No. 3; Botanical notes on Queensland, No. 4; On a Coal Plant from Queensland; Physical Structure and Geology of Australia, (pp. 18); On a Mesozoic *Mytilus* from the Barcoo; Botanical notes on Queensland, No. 5; On a specimen of Coral from Port Jackson; On *Brachyphyllum*, species from Mesozoic coal beds, Ipswich, Queensland. VOL. VIII.: On the Fossil Flora of the coal deposits of Australia, (pp. 130); On some Mesozoic Fossils from

Central Australia. Vol. IX.: Letter to Hon. W. Macleay, giving an account of travels in Perak; Report on the Geology and Physical Geography of the State of Perak, (pp. 28). 2nd Series, Vol. II.: A Statistical, Geographical, and Botanical Account of the Volcano of Taal, in the Island of Luzon, (pp. 125). Vol. III.: Fisheries of the Oriental Region, (pp. 90); Geographical Notes in Malaysia and Asia, (pp. 93); Malaysian Land and Freshwater Mollusca, (pp. 97). Vol. IV.: Essay on the Vegetation of Malaysia, (pp. 97). Also, in co-operation with Mr. F. M. Bailey—Vol. IV.: A Census of the Flora of Brisbane. Vol. V.: On some of the Fungi of N.S.W. and Queensland. Also, the Presidential Addresses for the years 1880 and 1881.

In the *Proceedings of the Royal Society of Tasmania* the following papers appear :—(1874) Notes on the Physical and Zoological relations between Australia and Tasmania; (1875) On some new species of Tasmanian Marine Shells; On some Tertiary Fossils from Table Cape; On the genus *Fenestella*; On the Freshwater Shells of Tasmania; Description of new Tasmanian Shells; (1876) History of Australian Tertiary Geology; On some Tasmanian Patellidæ; On a new genus of Nudibranchiata; On some new Tasmanian Marine Shells; On *Ampullaria*, n.sp.; Fossil Echinodermata; Notes on Ditto; (1877) Census with brief descriptions of the Marine Shells of Tasmania and the adjacent Islands; On Tasmanian Siphonaria, including a new species; On some new Tasmanian Marine Shells; (1878) On some new Tasmanian Marine Shells; On some Tasmanian Freshwater Univalves; (1879) On some Tasmanian Trochidæ; Notes on *Bythinella*, &c.; (1880) On some introduced Plants of Australia and Tasmania.

In the *Proceedings of the Royal Society of New South Wales* we find :—Vol. X.: On some Tertiary Australian Polyzoa; Vol. XI.: On the Tertiary deposits of Australia; On some new Australian Polyzoa; The Palæontological evidences of Australian Tertiary formations; On some Australian Tertiary Corals; Vol. XII; Tasmanian Forests, their Botany and Economic Value; The Molluscan Fauna of Tasmania; On some Australian Tertiary

Fossil Corals and Polyzoa; Vol. XVI.: The Hawkesbury Sandstone; On some Carboniferous Marine Fossils; On some Mesozoic Fossils from the Palmer River, Queensland; A fossil plant formation of Central Queensland; Vol. XVII.: On the Waianamatta Shale; Vol. XXII.: On the Desert Sandstone; and, finally, On the Anatomy and Life History of Mollusca peculiar to Australia. This last paper obtained the Society's Medal and Prize offered for the best original work on the subject proposed. To Mr. Woods was also awarded the Clarke Medal of the same Society for the year 1888.

Transactions of the Philosophical Institute of Victoria.—Vol. II.: Observations on Metamorphic Rocks in S. Australia: Vol. III.: Remarks on a Tertiary Deposit in S. Australia; Vol. IV: On some Tertiary Deposits at Portland Bay, Victoria.

Royal Society of Victoria.—Vol. VI.: On some Tertiary Fossils in S. Australia; Vol. VIII.: On the Glacial Period in Victoria; Vol. XIV. (1879): On some new Marine Mollusca; Vol. XVI.: On the genus *Amathia* of Lamouroux, with descriptions of new species; List of Authors who have written directly or indirectly on Polyzoa; Vol. XVII.: The Hodgkinson Gold Fields, Northern Queensland; On some new Marine Mollusca.

Transactions of the Philosophical Institute of Adelaide.—(1865) The Tertiary Rocks of S. Australia.—Part 1. Introduction; Part 2. The Mount Gambier Fossils; Part 3. Brachiopoda; (1866) The same continued.—Part 4. Fossil Echinidæ; The Geology of the South-East; (1878) On some Fossil Corals from Aldinga; (1879) A List of Australian Star Fishes.

Royal Society of S. Australia.—(1880) On some fossil and recent species of Australian Seleniaridæ; On some New Corals from Australian Tertiaries.

Proceedings of the Queensland Philosophical Society.—Vol. III. (1881): Geology of Northern Queensland.

Palæontology of New Zealand.—Part IV.: Corals and Bryozoa of the Neozoic Period in New Zealand, 1880.

Journal of the Straits Branch of the Royal Asiatic Society.—No. 13. On the Stream Tin Deposits of Perak; No. 14. A journey to the Summit of Gunong Bubu.

Nature.—Vol. 31: Physical Geography of the Malayan Peninsula.—The Borneo Coal Fields; Vol. 33: The Geology of Malaysia, S. China, &c.

REPORTS, PAMPHLETS, &c.

North Australia; its Physical Geography and Natural History, pp. 46. Adelaide, 1864. Geology of Portland; Two Lectures, Portland, Victoria, 1865. Report on the Geology and Mineralogy of the S.E. district of S. Australia. Adelaide, 1866. Report on the Wilde River and Great Western Tin Mine. Brisbane, 1881. Lectures on the Burrum Coal Field, Queensland, with map. Maryborough. 1881. On the Natural History of N.S.W. Sydney, 1882. Coal Resources of Queensland. Brisbane, 1883. Report on the Geology and Mineralogy of the Northern Territory. Adelaide, 1887.

LETTERS TO NEWSPAPERS.

The Australasian.—(1866) Physical Geography of Australia, 6 letters; (1867) A trip to Wood's Point, 4 letters; (1879) A trip to a Coral Reef; (1880) A few words about Lichens; Australian Coral Reefs, 6 letters.

The Sydney Mail.—(1879) Wonders of Nature in Australia, 10 letters; (1880) Notes made in N. Australia, 12 letters; (1882) A visit to the Wilde River, 12 letters; (1883) Coal Plants of Australia, 12 letters.

South Australian Advertiser.—(1879-80) Northern Queensland, 12 letters.

Sydney Morning Herald.—(1880) Nature in the Far North, 18 letters; (1882) A day with the Myalls, 2 letters; (1884) Earthquake in Straits of Sunda, 3 letters; A journey through Java, 20 letters; An exploration in Perak, 7 letters; (1887) Explorations in N. Australia, 8 letters; A trip to the Victoria River, 2 letters; Notes of Travel, 7 letters; The Coal Trade between Australia and the East, 6 letters.

Bundaberg and Mount Perry Mail.—No. 477, 1881: The Carboniferous Rocks of the Lower Burnett.

Besides these contributions to the current literature of Natural History, I may mention the following important works:—Geological Observations in South Australia. 1 vol., London and Melbourne, 1862; History of the Discovery and Exploration of Australia. 2 vols., London, 1865; Fish and Fisheries of New South Wales. 1 vol., Sydney, 1882.

The following sketch of Mr. WOODS's life and works is taken from a biographical notice which appeared in the *Adelaide Advertiser* of Oct. 8, 1889, and which is attributed to the pen of a very near relative who writes with special authority.

"The Rev. Mr. WOODS was the son of Mr. JAMES DOMINICK WOODS, of the Middle Temple and of Sydenham, Kent, who held a leading position on the literary staff of the *Times* for 40 years. His mother was HENRIETTA MARIA ST. ELOY, the daughter of the Rev. JOSEPH TENISON, of Donoughmore Glebe, in the County of Wicklow, Ireland. His maternal grandfather was the Bishop of Ossory, who was the nephew of the Most Rev. THOMAS TENISON, Archbishop of Canterbury. Mr. WOODS was born at West Square, London, on November 15, 1832." When his school education was completed he became associated with the Rev. CANON OAKLEY of Islington, whom he assisted in establishing the Catholic Schools of that suburb. After a temporary attachment to the Order of Passionists, he proceeded to France, when he became one of the Professors at the College for Naval Cadets at Toulon. Here his taste for geology and natural science received its first development.

Returning to England in about four years, he made the acquaint- of Dr. WILLSON, Roman Catholic Bishop of Tasmania, with whom in 1855 he went to that colony to establish a system of schools for the education of Roman Catholic children.

From Tasmania he removed to South Australia, where he was ordained in 1857, and where he remained for some years, engaged both in mission work, and in the organisation of the Roman

Catholic Schools of that colony. He afterwards became a missionary priest in New South Wales, with Sydney as his head quarters. In 1883, on the invitation of Sir F. A. WELD, K.C.M.G., Governor of the Straits Settlements, he proceeded to Singapore in order to explore Malacca and furnish the Government with some reliable information as to its geology and mineral resources. On his way thither he stayed for a time in Java, and was witness to one part of the eruptive outbreak at Krakatoa. He ascended two of the volcanoes while they were in eruption, and his experiences, as detailed in a private letter, were such as to determine him not to try the experiment again. His description of the scenes he encountered whilst passing through the Straits of Sunda was shocking. The sea was literally covered with corpses. However, it did not discourage him from adventures in other parts of the East, not less hazardous than the ascent of active volcanoes. Mr. WOODS traversed the island of Java from end to end, and performed the same arduous task through Siam and Malacca, in each of which places he enriched the scientific literature of the world with his observations on the geology and botany of the regions he passed through. Sir FREDERICK WELD, shortly after Mr. WOOD'S arrival in Singapore, left the colony on leave, but before his departure he furnished Mr. WOODS with credentials to the native princes, who assisted him in every way they could. Before he left Singapore the Colonial Secretary of that colony advised the British Government of the arrival of the Rev. Mr. WOODS, and urged the desirableness of engaging his services to report to the Admiralty upon the coal resources of the eastern seas. The Admiralty accordingly detached from the naval squadron in the China Seas the Corvette "H.M. Pegasus," Captain BICKFORD, to enable Mr. WOODS to make the necessary investigations. He thus visited and explored many parts of Borneo, Siam, Malacca, the Philippine Islands and other places. His reports to the Admiralty have not been made public, but their value was recognized in the munificent way in which Mr. WOODS was rewarded for his investigations and descriptions. In a private letter from one of the principal naval officers on the

Chinese Station the remark was made that Mr. WOODS' discoveries as to the coal resources of the East had increased the strength of the British Navy in that part of the world by a force better than half-a-dozen good-sized frigates. After a lengthened cruise Mr. WOODS arrived at Hong Kong, where he was most cordially welcomed and entertained by Sir G. BOWEN and the Admiral of the station. Then he went to ascend the Hoang Ho, but was compelled by the state of his health to return. He came back to Australia in "H.M.S. Flying Fish," which landed him at Port Darwin. Here Mr. J. L. PARSONS, the Government Resident on the Northern Territory, engaged his services to visit and report upon the mineral districts of that portion of the country. After a short visit to Queensland he returned to Sydney after an absence of about four years.

Now, however, the continued hardships which he had undergone began to tell upon him, and his health slowly but surely gave way. "For nearly two years he was confined to his house, and latterly he was so debilitated that he was unable to see any but his immediate attendants. He suffered greatly, but he bore his afflictions with remarkable fortitude, and he accepted his fate with resignation. His departure from life was soothed by all the ministrations of that religion to which he had devoted his life, and he left the world in which his career had not been barren of results with no regrets such as might disturb a mind less evenly balanced and of religious convictions less assured than his own."

He had here many kind and considerate friends (among whom you will readily understand that Sir WILLIAM MACLEAY held a prominent place), but he had been exposed to troubles of which he made no complaint, but which seemed to have made a lasting impression on his naturally sanguine and happy temperament. On this head I quote a few sentences selected from a brief but affectionate memoir of the departed, which appeared in the *Centennial Magazine*, Sydney, January 1, and was written by his friend and our fellow member, the Rev. J. MILNE CURRAN, now of Bathurst :—"Of his personal character the public knew little.

He was a most genial companion and a sympathetic friend. There was a certain vein of sadness in his manner. The deep lines of care that furrowed and seamed his face were noticeable to many who knew nothing of his inner life. Even though in latter years tedious work was for him a stern necessity, he never lost that genial affability that charmed his friends. A glance through his correspondence shows that he had to bear trials that well-nigh embittered many years of his life. His sensitive nature never rallied from the hardships that induced him to leave Adelaide. He was forced to learn, too, that after doing his all, in giving the best years of his life to the service of Religion, he had to face actual need, or appeal to the charity of his friends. While his name was spoken of with honour and his work pointed to with pride by his co-religionists, he was himself on the very verge of want." Again, "shortly before his death he was given to understand that he should comply with an exceptionally exacting Church regulation—'It is very hard, very hard,' I heard him say, 'but I hope to practise a little of what I have been teaching.'"—*Requiescit in pace.*

I have drawn up a list of the Learned Societies, Institutions, Government Departments and Journals with which this Society is in correspondence, and to all of which our Proceedings are regularly forwarded.

The consequent Exchanges and Donations which we have received during the year are entered in each case. But for the sake of simplicity the words *Volume*, *Tome*, *Band* and the like are omitted before the Roman numerals, and the words *Part*, *Number*, *Heft*, *Fasciculus*, &c., are in like manner left out before the Arabic numerals.

AUSTRALIA.

Sydney—Australian Museum.
Mem. 2nd.—Rept. Lord Howe Island.
Trustees' Rept. (1888).
Lendenfeld, Monograph on Horny Sponges.

Sydney—Australian Museum.
Ramsay, Birds of N.S.W.
Comm. Technolog. Mus. Useful Plants, J. H. Maiden.
Comm. Technolog. Mus. Rept. (1888).

„ Free Public Library.
Reports (1888) (1889).

„ Parliamentary Library.

„ Royal Society of New South Wales.
Proc. XXII. 2. XXIII. 1.
Lib. Catalogue.

„ University Library.
Calendar Univ. Sydn. (1889).

„ Department of Mines.
Memoirs of Geol. Surv. N.S.W.—Palæontology, 2.—Tertiary Fl. Austral. v. Ettingshausen.
Melbourne Exhibition (1888), Descr. Cat. N.S.W. Mineral Court.

[*Note.*—The Government of N.S.W. also purchase, at the rate of £1 per vol., 100 copies per annum of the Proceedings for public distribution.]

Melbourne—Field Naturalists' Club of Victoria.
Vict. Naturalist V. 9, to VI. 5, and 9th Ann. Rept. F.N.C. V.

„ University Library.

„ Royal Society of Victoria.
Proc. (New Series) I. (1889).

„ Public Library.
M'Coy, Prodromus of Zoology of Vict., XVII., to XIX.
Repts. &c. (1887-88).

„ Zoological and Acclimatization Society of Victoria.

„ Department of Mines and Water Supply.
Mines Reports, Jan.-Dec. (1888). Ann. Rept. (1888).

Melbourne—Field Naturalists' Club of Victoria.
" Roy. Comm. Sanitary Cond. Melb. Repts. (1889).
" Mineral Statistics Vict. (1888).

Adelaide.—Botanic Garden.
Rept. (1888).
" Parliamentary Library.
" Royal Society of South Australia.
Trans. XI. XII.
" Public Library.
Rept. (1888).

Brisbane—Parliamentary Library.
" Queensland Museum.
Rept. (1888).
" Royal Society of Queensland.
Proc. V. 4; VI. 1, 2, 3, 4, 5.
Rept. Ann. Mtg. (1889).

Townsville—Geological Survey.
The Mineral Wealth of Qld. R. L. Jack, Govt. Geologist.
Rept. on Geol. of Russel R. ditto.
Rept. on Coal on Flinders R. ditto.
Second Rept. on Mt. Morgan, ditto.
Rept. Limestone Distr. Palmer R. ditto.
Rept. Tarangamba G. M. ditto.
Dept. Agriculture.—Rept. on Insect and Fungus Pests. 1.

Perth—Parliamentary Library.

TASMANIA.

Hobart.—Royal Society of Tasmania.
Abstr. Proc. Nov. 13 (1888) to Oct. (1889); Proc. (1888); Rept. (1888); Pres. Address (1889).
" Parliamentary Library.
Geol. Tasm. R. M. Johnston. From the Premier of Tasmania.

New Zealand.

Auckland—Museum.
Rept. (1888-89).

Christchurch—Museum.

Otago—Museum.

Wellington—Colonial Museum.
Transactions N.Z. Inst. XX.-XXI. (1888).

British Islands.

Cambridge--Philosophical Society.
Proc. VI. 4-6 ; Trans. XIV. 3 (1889).

Leeds—Conchological Society of Great Britain and Ireland.
Journ. V. 12 to VI. 3 (1889).

London—British Museum.

„ British Museum (Natural History), South Kensington.
B.M.C. Birds, XIV.; Foss. Rept. etc. 1-2; Marsup.; Foss. Cephalop. 1 ; Foss. Fish 1 ; Chelonians.

„ Entomological Society, Chandos St.
Trans. 1888, pt. 3, to 1889, pt. 3.

„ Geological Society, Burlington House.
Quarterly Journal, XLIV. 4, to XLV. 4 (1889).

„ Linnean Society.
Journ. Bot. XXIII. 156, 157, XXIV. 163, 164, XXV. 165-170, XXVI. 173 ; Zool. XX. 119-121, XXI. 132, XXII. 140; Gen. Ind. &c.

„ Zoological Society.
Proc. (1888) pt. 3 to (1889) pt. 2.
Abstr. Nov. 20 (1888) to Nov. 5 (1889).

„ Royal Microscopical Society.
Journal (1888) pt. 6 to (1889) pt. 5.

„ Royal Society.
Proc. XLIII. XLIV. XLV. 276 (1889).

Oxford—University Museum.
Cat. Adds. Radcl. Lib. (1888) 2 pts.

SCOTLAND.

Edinburgh—Royal Society.
Trans. XXVII, to XXX. 1 (1872-81); Proc. 103 to 109 (1872-81).
„ University Museum.
„ Royal Physical Society.
Proc. IX. 3 (1888).

IRELAND.

Dublin—University Museum.
„ Royal Dublin Society.
Trans. Ser. 2, I. 1-25, II. 3 pts. III. 1-10, IV. 2-5; Proc. I. 3 pts. II. 7 pts. III. 7 pts. IV. 9 pts. V. 1-2, VI. 1-6 (1889).

CANADA.

Montreal—Montreal Society of Natural History.
Record, I. 1-2, III. 4-7 (1889).
„ Royal Society of Canada.
Proc. and. Trans. III.-VI. (1885-88).
Ottawa—Geological and Natural History Survey, Sussex Street, Ottawa.
Palæont. Canada, I. 2.
Toronto—The Canadian Institute.
Proc. Ser. 3, VI. 1 (1888).

INDIA.

Bombay—Bombay Natural History Society.
Journ. III. 4, to IV. 2 (1889).
Calcutta—Asiatic Society of Bengal.
Proc. (1889) 1-10, Journ. lvi. II. 2-5, lvii. II. 4 (1888), lviii. I. 1, II. 1, 2.
„ Geological Survey of India, Indian Museum.
Bibliography. Records XXI. 4, to XXII. 3 (1889).

UNITED STATES OF NORTH AMERICA.

Boston—Boston Society of Natural History.
Proc. XXIII. 3, 4 (1888).

Boston—American Academy of Arts and Sciences.
Proc. n.s. XV. 1.

Cambridge, Mass.—Museum of Comparative Zoology at Harvard College.
Bull. XVI. 2, to XVII. 4 (1889), Rept. (1888).

Cincinnati—Society of Natural History.
Journ. IV. V. 1, VIII. 3, XI. 1-4 (1889).

New York—American Museum of Natural History.
Ann. Rept. (1888). Bull. II. 3. Rept. Central Park Menagerie (1888).

,, New York Academy of Sciences.
Ann. IV. 5-8, Trans. VII. 3-8 (1888).

,, The Editor of "Journal of Comparative Medicine and Surgery," Botanic Gardens.
Journ. X. 1-4 (1889).

,, American Geographical Society.
Bull. XX. 4, and Suppt., to XXI. 3 (1889).

Philadelphia—Academy of Natural Sciences.
Proc. (1888) 2, 3.

,, The Editor of "American Naturalist."
A.M., XXII. 262 to XXIII. 272. (Except 266 and 270 *not received).*

,, American Philosophical Society.
Proc. XV. 128 (1888).

,, Wagner Free Institute of Science.

San Francisco—Californian Academy of Natural Sciences.

Washington—Smithsonian Institution.

,, United States National Museum.
Proc. I.-IX. X. 46-49, XI. 1-42; Bull. 4, 7. 8, 11, 13-24, 27-31; International Exh. (1876) Animal Resources, U.S.

,, United States Geological Survey.
Bull. 40-47 (1888); Geol. Leadville; Min.

,, Resources, U.S. (1887).

Washington—Bureau of Ethnology, Ann. Repts. II.-IV.
„ Department of Agriculture.
Baltimore—Johns Hopkins University.
Circulars VI. 65 and 67, VIII. 68 and 74 (1889); Studies Biol. Lab. IV. 3, 4 (1888).
Granville, Ohio—Denison University.
Bull. IV. (1888).
New Haven—Connecticut Academy of Arts and Sciences.
Salem, Mass.—Essex Institute.
Bull. XIX. (1887).

FRANCE.

Cherbourg—Société Nationale des Sciences exactes et naturelles et Mathématiques de Cherbourg.
Paris—Académie des Sciences de l'Institut de France.
Ctes. Rend. CVIII.-CIX. 13 (1889).
„ Feuille des Jeunes Naturalistes.
219-229 (Nov. 1889); Cat. Bibl. 4-6.
„ Jardin des Plantes.
„ Société Entomologique de France.
„ Société Zoologique de France.
Bull. XIII. 8, to XIV. 6 (1889) (except XIII, 9 and XIV, 3, *not received)*; Mém. I, 3 (1888).
„ The Director of the "Journal de Conchyliologie."
Marseilles—Musée d'Histoire Naturelle de Marseille.
Ann. Zool. II. (1885).
Caen—Société Linnéenne de Normandie.

BELGIUM.

Antwerp—Société Royale de Géographie d'Anvers.
Bull. VII. 3, 4, IX. 3, X. 1, 2, 6, XI, 1-3, XII. 2-3 (1889); Mém. II. (1883); Mém. I. 3 (1888).
Brussels—L'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique.
Bull. XIV.-XVII. Annuaire (1889).

Brussels—Société Entomologique de Belgique.
Ann. XXXI. (1887).
„ Société Royale Malacologique de Belgique.
Ann. XXII. (1887). Proc. Verb. Jan.-June 1888.
„ Société Royale de Botanique de Belgique.
Liège—Société Royale des Sciences de Liège.
Mém. Ser. 2, XV. (1888).
„ Société Royale Géologique de Belgique.
Ann. XIII.-XVI. I (1889).

NETHERLANDS.

Amsterdam—Académie Royale des Sciences.
Jaarboek (1886-87); Verslagen en Mededeelingen, Ser. 3, III. IV. (1887-88),
„ Société Royale de Zoologie, Natura Artis Magistra
Bijdragen 14-16; Feest Nummer (1888).
Hague—Nederlandsche Entomologische Vereeniging.
Tijdschr. XXXI. (1888).
Harlem—Société Hollandaise des Sciences Naturelles à Harlem.
Arch. XXIII. 1-5 (1889).

GERMANY.

Berlin—The Editor of "Archiv für Naturgeschichte."
lii. II. 3, liii. II. 1, liv. I. 1, 2, II. 2, lv. I. 2.
„ Gesellschaft für Erdkunde.
Bonn—Naturhistorischer Verein der Preussischen Rheinlande und Westfalens.
Verhandl. (Folge 5), V. 5 to VI. 1 (1889).
Bremen—Naturwissenschaftlicher Verein.
Abhandl. X. 3 (1889).
Frankfurt on Main—Senckenbergische Naturforschende Gesellschaft in Frankfurt a/M.
Abhandl. XIV. 2 and 3 (1886), XV. 3 (1888).
Bericht 1886.
Frankfurt on Oder—Naturwissenschaftlicher Verein des Regierungs-bezirkes Frankfurt.
Monat. Mitth. VI. 1-9; Soc. Lit. II. 5-10.

Halle—Kaiserliche Leopoldino-Carolinische deutsche Akademie der Naturforscher zu Halle.
N. Acta. L. 6, LI. 2, 5, 6, LII. 5 ; Leopoldina, LII., 22-24 (1888), LIII. 1-3 (1889).

Hamburg—Naturhistorisches Museum der freien Stadt Hamburg.
„ Naturwissenschaftlicher Verein.
Abhandl. I.-V. VII. 1 (1880).

Leipzig—Dr. J. Victor Carus, Editor of "Zoologischer Anzeiger."
Z.A. XI. 293, to XII. 321 (1889).
„ Verein für Erdkunde zu Leipzig.

Stuttgart—Verein für vaterländische Naturkunde in Württemberg.
Jahresheft XLV. (1888).

AUSTRIA.

Vienna—Kaiserlich-Königliche Zoologisch-botanische Gesellschaft.
Verhandl. XXXVIII. 1-4 (1888).
„ Kaiserlich-Königliche Naturhistorisches Museum.
Ann. III. 2, 3, 4 (1888).

SWITZERLAND.

Bern—Naturforschende Gesellschaft.
Mittheilungen (1887).

Geneva—Société de Physique et d'Histoire Naturelle de Genève.
Mém. XXX. 1 (1888).

SWEDEN.

Stockholm—Entomologiska Foreningen.
Tidskr. I.-III. VI. IX. X. 1 (1889).

Upsal—Société Royale des Sciences.

NORWAY.

Christiania—Kongelige Norske Frederiks Universitet.

DENMARK.

Copenhagen—Kongelige Danske Videnskabernes Selskab.
Bull. (1888) Nos. 2, 3, (1889) No. 1.

Copenhagen—Naturhistoriske Forening i Kjobenhavn.
Medelelser (1888).

ITALY.

Genoa—Museo Civico di Storia Naturale.
Annali, Ser. 2, III.-VI. (1888).

Naples—Zoological Station.
Mitth. VIII. 3, 4, IX. 1 (1889).

RUSSIA.

Moscow—Société Impériale des Naturalistes.
N. Mém. XV. 6 (1889).
Bull. (1888), Nos. 3, 4; (1889), No. 1.

St. Petersburg—Académie Impériale des Sciences.
Mém. Ser. 7, XXXVI. 1-11 (1888).
Bull. XXXII. 2-4.

" Comité Géologique Institut des Mines.
Mém. III. 4, VIII. 1.
Bull. VII. 6-10, VIII. 1-5; Suppl. (1889).

" La Société Entomologique de Russie.
Horæ XXII. (1888).

Odessa—Société des Naturalistes de la Nouvelle-Russie.
Zapiski, XIII. 2, to XIV. 1 (1889).
Z. Math. IX. (1889).

Kieff—La Société des Naturalistes.

Helsingfors—Société des Sciences de Finlande.
Acta XV.; Bidrag t. Kännedom Fin. Natur o. Folk. 45-47.
Finska Vetenskaps Soc. XXVIII.-XXIX. etc.

" Societas pro Flora et Fauna Fennica.
Acta III.-IV. (1888), Meddelanden af S. 140, (1888).

JAVA.

Batavia—Kongl. Natuurk. Vereeniging in Nederl.-Indië.
Tijdschrift, XLVIII. (1888).

JAPAN.

Tokyô—College of Science, Imperial University.
Journ. II. 4.5, III. 1-2 (1889).

The Library of the Society has been further enlarged by many donations, amounting in all to over 900 volumes. Of these over 700 have been presented by SIR WILLIAM MACLEAY and include many serial and other works of great value. They are as follows:—

"Philosophical Transactions of the Royal Society of London." 65 vols. (1801-58 and 1881-87); "Transactions of the Royal Society of Edinburgh." 21 vols., with 6 Parts and 2 Appendices (1788-1881); "The Edinburgh Philosophical Journal." 90 vols. (1819-1864); "Nature." 13 vols. (1876-1882); "Zeitschrift für wissenschaftliche Zoologie." Bd. I.-XXXIX.; XLVI. Hefts 3 and 4; XLVII. Hefts 1 and 2 (1849-1888); "The Botanical Cabinet." By C. Loddiges and Sons. 21 vols. (1818-1833); "The Journal of Botany." 17 vols. (1863-1879); "Annales de la Société Entomologique de Belgique." Tomes I.-XXV. (1857-1882); "Tijdschrift voor Entomologie." Vols. I.-XXI. (1858-1878); "Entomologische Zeitung, herausgegeben von dem Entomologischen Vereine zu Stettin." Jahrg. I.-XLVIII. (1840-1887); Mittheilungen aus der Zoologischen Station zu Neapel." Bd. I.-III. (1878-1882); "Archives de Biologie." Tome VIII. (1888); "Notes from the Leyden Museum." Vol. X., Parts 1-3 (1888); "Novæ Hollandiæ Plantarum Specimen." Auctore J. J. Labillardière. 2 vols.; "Roberti Brownii Prodromus Florae Novæ Hollandiæ et Insulæ Van-Diemen;" "Ichtyologie, ou Histoire Naturelle des Poissons." Par M. E. Bloch. 6 vols. (1785-1788); "Fragmenta Phytographiæ Australiae, Contulit Ferdinandus Mueller." Vols. I.-V. (1858-1866); "The Natural History of the Tineina." By H. T. Stainton, assisted by Prof. Zeller and J. W. Douglas. 13 vols. (1855-1873); "Reports of Explorations and Surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to thePacific Ocean, 1853-4." 12 vols. (1855-1860); "Proceedings of the Academy of Natural Sciences of Philadelphia." 28 vols. (1841-1876); "Proceedings of the Boston Society of Natural History." Vols. I.-XII. (1844-69), XIII.-XX., Parts 1-3 (1869-1880); "Berliner Entomologische Zeitschrift—herausgegeben von dem Entomologischen Vereine in Berlin." Jahrg. I.-XXXII. (1857-1888);

"The Geologist." Vols. I.-VII. (1858-1863); "The Geological Magazine, or Monthly Journal of Geology." 14 vols. (1864-1882); "The Natural History Review." 12 vols. (1854-1865); "Encyclopædia Britannica." 9th Edition. Vol. XXIV. (1888); "On the Anatomy of Vertebrates." By R. Owen, F.R.S. 3 vols.; "Elementary Text-book of Zoology." By Dr. C. Claus, translated and edited by A. Sedgwick, M.A. 2 vols.; "A Text-book of Physiology." By M. Foster, M.D., &c. 5th Edition, Part I. 1888; "A Text-book of the Physiological Chemistry of the Animal Body." By A. Gamgee, M.D., &c. Vol. I.; A Text-book of Pathological Anatomy and Pathogenesis." By Ernst Ziegler, translated by Donald Macalister, M.D. 2 vols.; "Elements of the Comparative Anatomy of Vertebrates." By R. Wiedersheim, adapted by W. N. Parker; "A Course of Elementary Practical Physiology." By M. Foster, M.D., and J. N. Langley, M.A., &c. 5th Edition; "The Elements of Embryology." By M. Foster, M.D., &c., and the late F. M. Balfour, M.A., &c.; "A Course of Elementary Instruction in Practical Biology." By T. H. Huxley, LL.D., &c., assisted by H. N. Martin, M.D., &c.; "An Introduction to the Osteology of the Mammalia." By W. H. Flower, LL.D., &c.; "Micro-Organisms and Disease." By E. Klein, M.D., &c.; "Anthropology." By E. B. Tylor, D.C.L., &c.; "A Course of Practical Instruction in Botany." Parts I. and II. By F. O. Bower, D.Sc., &c.; "Physiography." By T. H. Huxley, F.R.S.; "Lectures on the Physiology of Plants." By Julius von Sachs, translated by H. Marshall Ward, M.A.; "Outlines of Classification and Special Morphology of Plants." By Dr. K. Goebel, translated by H. E. F. Garnsey, M.A.; "Comparative Anatomy of the Vegetable Organs of the Phanerogams and Ferns." By Dr. A. de Bary, translated by F. O. Bower, M.A., and D. H. Scott, Ph.D., &c.; "The Geological History of Plants." By Sir. J. William Dawson, C.M.G., LL.D., &c.; "Geology—Chemical, Physical, and Stratigraphical." By Joseph Prestwich, M.A., &c. 2 vols.; "Three Expeditions into the Interior of Eastern Australia." By Major T. L. Mitchell, F.G.S., &c. 2 vols.; "Travels of a Naturalist in Japan and Manchuria." By Arthur Adams,

F.L.S., &c.; "A Course of Lectures on Electricity." By George Forbes, M.A., &c.; "The Story of Creation." By Edward Clodd; "Modern Theories of Chemistry." By Dr. Lothar Meyer, translated by P. Phillips Bedson, D.Sc., &c., and W. C. Williams, B.Sc. The following Journals, Magazines, &c., for 1889 as published: "The Athenæum;" "Annals and Magazine of Natural History;" "English Mechanic;" "Entomologist;" "Entomologists' Monthly Magazine;" "The Field;" "Geological Magazine;" "The Ibis;" "Journal of Anatomy and Physiology;" "Journal of Botany;" "Nature;" "Proceedings of the Royal Geographical Society;" "Quarterly Journal of Microscopical Science;" "Science Gossip;" "The Zoologist;" "The Scottish Geographical Magazine." "Transactions of the Royal Society of Edinburgh." Vols. VIII., XXI. (Part 4), XXII. (Parts 1 & 3), XXIII., XXIV., XXVI. (Part 4), XXVIII. (Parts 2 & 3), XXIX. (1817-80); "Transactions of the Royal Irish Academy." Vols. I.-X., XVI., XVII., XVIII. (Part 1), XIX., XXI. (Part 1), (1787-1846); "Charter and Statutes;" "Index, 1786-1813;" "Mémoires de la Société de Physique et d'Histoire Naturelle de Genève." Tomes I.-XXII. (1871-73); "Premier Supplément au Tome XII.;" "Table des Mémoires, &c., T. 1.-XX.;" "Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft, Frankfurt a/M." Band I.-XII. (1854-81); "Annales des Sciences Géologiques." T. I.-XX. (Parts 1 and 2) (1869-88); "Annales des Sciences Naturelles—Zoologie." 6e Série. T. XV., XVI., XIX., XX. (1883-85); "Botanique." 6e Série. T. XVII.-XX. (1884-85); "Archives de Zoologie Expérimentale et Générale." 2e Série. Tomes IV. et V. (1886-87); "Zeitschrift für wissenschaftliche Zoologie." XLVII. Band, 3 and 4 Hefts (1888); "Namen und Sachregister über Band XXXI.-XLV." "Notes from the Leyden Museum." Vol. X., No. 4 (1888); "The Geological Magazine." Vols. VIII.-X. (1871-73); New Series (Decade II). Vols. VII. and VIII. (1880-81); "Coloured Figures of English Fungi or Mushrooms." By James Sowerby, F.L.S. 3 Vols. and Supplement (1797-1803); "Curtis's Botanical Magazine." 3rd Series. Vol. XLIV. (1888); "Stettiner Entomologische Zeit-

ung." 49 Jahrg. (1888). "The Transactions of the Royal Irish Academy. Vols. XI.-XV.; XVIII.; XX.-XXVIII.; XXIX. (Parts 1-5), (1810-89); "Journal of Botany," n.s. Vols. VIII., No. 204 (December, 1879); IX.-XI. (1880-82); "Encyclopædia Britannica." 9th Edition, Index; "Nouvelles Archives du Muséum d'Histoire Naturelle, Paris." 2nde. Série. Tome X., Fasc. 2 (1888); "Notes from the Leyden Museum." Vol. XI., No. 1 (1889); "The Origin of Floral Structures through Insect and other Agencies." By the Rev. George Henslow, M.A., F.L.S., &c.; "The Morphology of the Skull." By W. K. Parker, F.R.S., and G. Bettany, M.A., B.Sc.; "Berliner Entomologische Zeitschrift—herausgegeben von dem Entomologischen Verein in Berlin." Band XXXII., Heft 2 (1888); "Stettiner Entomologische Zeitung." 50 Jahrg., Nos. 1-3 (1889). "Reichenbachia. — Orchids Described and Illustrated by E. Sander, &c." Vol. I. (12 parts); II. parts 1-5, [1888-89]; Vol. II., Part 7 (1888); "A History of British Fossil Reptiles." (4 vols). By Richard Owen, K.C.B., F.R.S., &c.; "Challenger Reports—Zoology. Vols. XXIII.-XXV., XXVII., XXVIII., XXIX. and XXX.; "Narrative." Vol. I., Part 1.

The first two parts of the fourteenth volume of our Proceedings have been already published, the third is in print, and the fourth will be issued at an early date.

The following abstract of the work which this volume represents may, I hope, be found of some assistance to the inquirer in following up references to other parts of our Proceedings, as well as to those of the sister scientific societies established elsewhere among the English-speaking communities of the southern hemisphere.

Since the beginning of 1889 we have received copies of the aforesaid Proceedings as follows, viz. :—

Royal Society of N.S.W., Vol. XXII., Part 2; Vol. XXIII., Part 1.

Royal Society of Tasmania, volume for 1888.

Royal Society of Victoria—Proceedings, Vol. I. (new series).

Royal Society of S. Australia—Proceedings, Vols. XI. and XII.

Royal Society of Queensland, Vol. V., Parts 4 and 5; Vol. VI., Parts 1-5.

Institute of New Zealand, Vols. XX. and XXI.

Royal Geographical Society of Australasia—

New South Wales Branch, none.

Victoria Branch, none.

Queensland Branch, Vol. III., Part 2; Vol. IV.; Vol. V., Part 1.

Australasian Association for the Advancement of Science, Vol. I., Sydney (1889).

Victorian Naturalist, Vol. V., No. 9, to Vol. VI., No. 8 inclusive.

The contributors to the current volume of our Proceedings are:—

A. Sidney Olliff, F.E.S.—New species *Phyllodes* described, p. 113; New species Cetoniidæ, described by O. E. Janson, F.E.S. (communicated), p. 127; On Rhopalocera from Mount Kosciusko, p. 619; *Pielus hyalinatus* and its allies, p. 641; New species of Lampyridæ, p. 643.

Rev. J. E. Tenison-Woods, F.G.S., F.L.S., &c.—Vegetation of Malaysia, p. 9.

J. H. Maiden, F.L.S., F.C.S.—Geographical distribution of some N.S.W. plants, compiled from information given by Baron v. Mueller and Mr. W. Bauerlen, p. 107; On Eucalyptus Kinos —Part i. The Ruby Group, p. 605; Part ii. The Gummy Group, p. 1277; On Spinifex Resin, p. 629; On the Gum from *Cedrela australis*, p. 1047; On the Pharmacology of some Australian Plants by T. L. Bancroft, M.D. (communicated), p. 1061.

F. A. A. Skuse.—On the genus *Lestophonus*, with description of a new species, p. 123; Genus *Batrachomyia*, Macleay, MS., 2

species described, p. 171; Diptera of Australia. Part vi.—The Chironomidæ, p. 215. Part vii.—The Tipulidæ brevipalpi, p. 757.

Rev. T. BLACKBURN, B.A., Corr. Mem.—Revision of the Genus *Heteronyx*. Part ii., p. 137. Part iii., p. 425. Part iv., p. 661. Supplement, p. 1217; Notes on Australian Coleoptera. Part iii., p. 445. Part iv., p. 707. Part v., p. 1247.

J. DOUGLAS OGILBY, F.L.S.—Australian Palæichthyes. Part ii., p. 178; *Hoplocephalus frontalis*, n.sp., described, p. 1027; *Lygosoma*, n.sp., and *Ablepharus*, n.sp., described, p. 1296.

J. C. COX, M.D., F.L.S.—On *Cypræa venusta*, Sow., p. 187; *Ancylus Smithi*. n.sp., and *Cypræa Irvineanæ*, n.sp., described, p. 658.

BARON VON MUELLER, K.C.M.G., &c., &c.—On the probable occurrence of *Aldrovanda vesiculosa* in N.S.W., p. 197; On *Eucalyptus Maideni*, n.sp., from N.S.W., p. 1020.

R. ETHERIDGE, JUNR. — On the Permo-carboniferous Fossils from N.W. Australia in the Macleay Museum, p. 199; Fructification of *Phlebopteris alethopteroides*, Lower Mesozoic of Queensland, p. 625; On the Biology of Lord Howe Island, p. 627; On the structure of *Conularia inornata*, and of *Hyolithes lanceolatus* with its operculum, p. 751.

Rev. Dr. WOOLLS, F.L.S.—On a collection of Plants obtained at King George's Sound by the Rev. R. COLLIE, F.L.S., p. 317.

Dr. OSCAR KATZ.—On the Bacillus of Leprosy, p. 325; On "Air-gas" for Bacteriological work, p. 328; On the Microbes of Chicken-cholera, p. 513.

W. J. STEPHENS, M.A., F.G.S.—An attempt to synchronise the Australian, South African, and Indian Coal Measures. Part 1, Australia and New Zealand, p. 331.

J. J. FLETCHER, M.A., B.Sc.—On the oviposition and habits of certain Australian Batrachians, p. 357; Notes on Australian Earthworms. Part vi., p. 987.

J. D. Cox and A. G. Hamilton.—On the Birds of the Mudgee district, p. 395.

T. W. Edgeworth David, B.A., F.G.S.—On the Origin of Kerosene Shale, p. 483.

T. G. Sloane.—Review of the genus *Sarticus* (Carabidæ), p. 1288; Studies in Australian Entomology, No. ii. p. 1288.

T. P. Lucas, M.R.C.S.—New species of *Iodis* described, with remarks on *Pielus imperialis*, Olliff, p. 603; On Queensland Macrolepidoptera, localities and new species, p. 1065.

J. Brazier, F.L.S.—On Mollusca trawled off Merimbula, p. 747.

W. J. McKay, B.Sc.—Osteology and Myology of *Acanthophis antarctica*, p. 893.

A. J. North, F.L.S.—On birds collected by Mr. E. H. Saunders, near Roeburne, N. W. Australia, p. 1023; On the nidification of two Australian species of Birds, p. 1050; Of two species from Lord Howe Island, p. 1296; On *Sternula sinensis* breeding in N.S.W., p. 1296.

C. W. de Vis, M.A., Corr. Mem.—*Tropidophorus Queenslandiæ*, (Scincidæ), n.sp., and *Perochirus Mestoni* (Geckonidæ), n.sp., description, p. 1034.

W. H. Miskin, F.E.S.—Revision of the Australian species of *Euplœa*, with 7 new species described, p. 1037.

K. H. Bennett, F.L.S.—On the breeding of *Ibis falcinellus*, p. 1059.

E. Meyrick, B.A., F.E.S.—Description of additional Australian Pyralidina, p. 1105; Revision of Australian Lepidoptera. Part iii., p. 1117.

E. P. Ramsay, L.L.D., F.L.S., and J. D. Ogilby, F.L.S.—*Lygosoma*, n.sp., description, p. 1296.

I have classified the more important papers in the Australian Scientific Serials as follows, referring under each head to the

authors of papers on similar subjects in the Linnean Society as enumerated above, and touching also on points of particular interest to Australian Students of Science which have been treated of elsewhere.

VERTEBRATES.

ANTHROPOLOGY.

Royal Society, N.S.W.—VOL. XXIII.: Aborigines of Australia. W. T. Wyndham.

New Zealand Institute.—VOL. XXI.: Col. Macdonnell on the Ancient Moa Hunters at Waingongoro. Communicated by James Park.

A Residence among the Natives of Australia. By K. Lumholtz. Bull. Am. Geog. Soc. XXI. 1; and Among Cannibals, an Account of Four Years' Travels in Australia and of Camp Life with the Aboriginals of Queensland. By the same author. London, J. Murray; Melbourne and Sydney, A. Petherick and Co.

MAMMALS.

Royal Society, South Australia.—VOL. XI.: On a new Australian Mammal. E. C. Stirling. See also Nature, XXXVII. p. 588; The Zoologist (3), XII. p. 424; Zool. Anz. XI. p. 647, &c.

New Zealand Institute.—VOL. XX.: On New Zealand Rats. A. Reischek, F. W. Hutton.

There is a note on the Nomenclature of the Short-eared New Zealand Bat (*Chalinolobus morio*, for *C. tuberculata*). Oldfield Thomas. Ann. and Mag. N.H. IV. 462.

The question as to the exact relations of the fossil Multituberculata (Fossil Marsupials—so called) to existing forms is discussed by H. F. Osborn (as quoted in last year's Address). Ac. Nat. Sc. Philadelph. p. 88. Upon this subject Prof. Cope (Amer. Naturalist, XXII. pp. 259, 723), referring to Mr. Poulton's observations upon the rudimentary and evanescent

teeth of *Ornithorhynchus*, concludes that it is probable that the said Multituberculata are allied more nearly to the Monotremes than to the Marsupials,

The Fœtal Membranes of Marsupials are treated by Mr. Osborn in the Journal of Morphology, I. p. 2.

BIRDS.

Linnean Society, N.S.W.—Cox and Hamilton, North, Bennett.

Royal Society, Tasmania.—*Anseranas melanoleuca* in Tasmania. W. F. Petterd; *Chibea bracteata* in Tasmania. Col. Legge.

Royal Society, Queensland.—VOL. V. Australian Ancestry of the Crowned Pigeon of New Guinea; *Colluricincla sibila*, new species, description. VOL. VI.: *Geosichla cuneata*, new species; *Sericornis gutturalis*, new species, description; On *Prionodura Newtoniana*; *Acanthiza squamata*, new species; *Pachycephala fretorum*, new species, description. C. W. De Vis.

New Zealand Institute.—VOL. XX.: Ornithological Notes; *Lobivanellus personatus* in New Zealand. T W. Kirk. VOL. XXI.: On some Birds from the Kermadec Islands; On *Diomedea cauta*. T. F. Cheeseman; On *Diomedea exulans*. A. Reischek; On *Sula fusca*. A. Hamilton; On *Athene Novæ Zealandiæ*. W. Colenso; Birds of Lake Brunner district. W. W. Smith; On *Apteryx Bulleri*, new species. R. Bowdler Sharpe; On *Notornis Mantelli* in West Otago. James Park; On some New Zealand Birds. T. W. Kirk.

Victorian Naturalist V.—Oology of Australian Birds, Supplement, Part 5. A. J. Campbell.

REPTILES AND AMPHIBIA.

Linnean Society, N.S.W.—J. Douglas Ogilby, J. J. Fletcher, W. J. McKay, C. W. De Vis, E. P. Ramsay.

Royal Society, Queensland.—VOL. V.: *Miculia orientalis*, new species, description. VOL. VI.: *Neospades*, a new genus of Natricidæ. C. W. De Vis.

Australasian Association for the Advancement of Science, Section D.—On the Pineal Eye in *Hinulia* and *Grammatophora.* W. J. McKay; On a *Myxosporidium* infesting Australian Frogs. A. W. Fletcher.

The position of *Meiolania* is discussed by Baur and Boulenger in Ann. Nat. Hist. (6) III. pp. 54, 138; IV. p. 37.

R. Lydekker in Ann. and Mag. N.H. (6) IV. p. 475, remarks that fossil skulls of a small Labyrinthodont from the Karoo formation, S. Africa, agree so closely with *Bothriceps,* Huxley, *presumably from the Hawkesbury beds of Australia* that they may be regarded as indicating a new species of that genus, for which he proposes the name *B. Huxleyi;* and that this instance is paralleled by the occurrence of *Cleithrolepis* in both deposits. See Q.J.G.S. XLIV. p. 141.

FISHES.

Linnean Society, N.S.W.—J. D. Ogilby.

Royal Society, Tasmania (1888).—Concise History of the Acclimatisation of the *Salmonidæ* in Tasmania. P. S. Seager; Results of attempts to acclimatise *Salmo salar* in Tasmania. R. M. Johnston.

New Zealand Institute.—VOL. XX.: On a specimen of *Regalecus.* T. Jeffrey Parker; Fishes of Mokohinou Islands. F. S. Sandager.

MISCELLANEOUS.

Royal Society, Queensland.—VOL. VI.: Observations on a Natural History Collection made on the cruise of H.M.S. "Myrmidon" at Port Darwin and Cambridge Gulf (1888), with descriptions of new species of fishes and birds. W. Saville Kent.

Australasian Association for the Advancement of Science, Section D.—On the Nomenclature of the Sexual Organs in Plants and Animals. T. Jeffrey Parker.

MOLLUSCA.

Linnean Society, N.S.W.—J. C. Cox, J. Brazier.

Royal Society, N.S.W.—Vol. XXII.: On the Anatomy and Life-history of Mollusca peculiar to Australia. J. E. Tenison-Woods.

Royal Society, Tasmania.—Contributions for a systematic Catalogue of the Aquatic Shells of Tasmania. W. F. Petterd; Critical observations on the above; Variability of the Tasmanian *Unio*. R. M. Johnston.

Royal Society, South Australia.—Vol. XI.: Lamellibranch and Palliobranch Mollusca of South Australia; Census of the Molluscan Fauna of Australia; Gastropods of the Older Tertiary of Australia. R. Tate.

Royal Society, Queensland.—Vol. V.: Errata in list of Land Shells recorded from Queensland. H. Tryon; *Limax Queenslandicus*, n.sp., described; On *Aneitea Graeffei* and its allies, C. Hedley. Vol. VI.: Anatomical Notes on Helicidæ. Parts 1-3.; Notes on Queensland Land Shells. C. Hedley.

New Zealand Institute. –XX.: On *Architeuthis longimanus*. n.sp. T. W. Kirk; On *Paryphanta lignaria*, n.sp. F. W. Hutton.

Victorian Naturalist.—V.: On *Voluta undulata* and its allied species. R. Tate.

Australian Association for the Advancement of Science, Section D.—On some new or little known genera of Australian Mollusca. R. Tate.

The Rev. A. H. Cooke (P.Z.S. 1889, p. 136) discusses the generic position of the *Physæ* (so called) of Australia, concluding that they are in reality sinistral Limnæidæ, characteristic of the lands of the S.E. Pacific, Africa and the Mediterranean.

ARTHROPODA.

INSECTS, SPIDERS, &c.

Linnean Society, N.S.W.—A Sidney Olliff, F. A. A. Skuse, T. Blackburn, T. G. Sloane, T. P. Lucas, W. H. Miskin, E. Meyrick.

Royal Society, South Australia.—VOL. XI.: New South Australian Coccidæ. W. M. Maskell; New species Australian Coleoptera. T. Blackburn. VOL. XII.: *Hectoria Pontoni*, n.gen., n.sp.; On Pores in Veins of some Diptera. F. S. Crawford; Further notes on Australian Coleoptera, T. Blackburn.

Royal Society, Queensland.—VOL. VI.: New species Queensland Butterflies; New species Rhopalocera, description. T. P. Lucas; New species Australian Hesperidæ, description; Revision of the Australian species of the Lepidopterous genus *Terias*, with description, new species; Notes on some undescribed Australian Rhopalocera. W. H. Miskin.

New Zealand Institute.—VOL. XX.: *Coccinella Novæ Zealandiæ*. W. Colenso; Supplement to Monograph on Noctuina of New Zealand; On New Zealand Geometrina; On New Zealand Pyralidina; On New Zealand Tortricina; On New Zealand Tineina. E. Meyrick; On *Henops brunneus*. W. M. Maskell; On new species of Araneidea. A. T. Urquhart; New species New Zealand Araneæ, description; Note on *Amaurobioides maritima*. P. Goyen. VOL. XXI.: On *Gryllotalpa vulgaris* in New Zealand. T. W. Kirk; On Gall-producing Insects in New Zealand. W. Maskell; On new species Araneidea; On new species *Gasteracantha*. A. T. Urquhart; New Zealand Micro-lepidoptera, new species, description. E. Meyrick; Natural History of three species of Micro-lepidoptera; Varieties of *Declana floccosa*. G. V. Hudson; *Hemideina nitens*, new species Locustidæ; On a peculiar Chrysalis; On *Pyrameis gonerilla*. W. Colenso.

Victorian Naturalist.—V.: On *Peripatus* in Victoria. A. Dendy. See also Nature XXXIX. pp. 366, 412; and *Peripatus*, Two monographs by A. Sedgwick, F.R.S. (Studies from the Morphological Laboratory in the University of Cambridge.)

The maturation of the Ovum in the Cape and New Zealand species of *Peripatus* is the subject of a paper by Lilian Sheldon Q.J.M.S. XXX. p. 1 (with 3 plates).

The Rev. O. P. Cambridge describes a very singular new genus of spider, *Chasmocephalon (C. neglectum)*, from Swan River. P.Z.S. 1889, p. 45.

CRUSTACEANS.

New Zealand Institute.—Vol. XX.: On *Anthosoma Smithii*. T. W. Kirk; Vol. XXI.: Distribution of the Freshwater Crayfish of New Zealand. Charles Chilton; Notes on New Zealand Crustacean Fauna. G. M. Thomson.

LOWER METAZOA.

Annelides.

Linnean Society, N.S.W.—J. J. Fletcher.

Transactions of the Royal Society of Victoria.—Vol. 1. Part 1: The Anatomy of *Megascolides australis*. W. Baldwin Spencer.

Royal Society, Queensland.—Vol. VI.: On Filariæ of Birds. T. L. Bancroft.

The Australian Oligochætæ *Cryptodrilus purpureus*, n.sp., *Acanthodrilus australis*, n.sp., are described by W. Michaelsen (Mtthg. N.H. Mus. Hamburg, VI.).

Polyzoa.

A. W. Waters describes Bryozoa from N.S.W. (Ann. and Mag. N.H. (6) IV., p. 1).

The Anatomy of *Phoronis australis*, W. B. Benham (Q.J.M.S., n.s., XXX. 2, p. 125).

Rotifera.

Royal Society, Queensland.—Vol. VI.: List of Queensland Rotifera. V. Gunson Thorpe.

COELENTERATES AND SPONGES.

Royal Society, Victoria.—Vol. 1 n.s.: Actinian Larva parasitic upon a Medusa; List of Sponges, described by H. J. Carter, with notes; Structure and development of *Stelospongus flabelliformis*. A. Dendy.

Victorian Naturalist.—Vol. V.: List of Australian Hydroida. W. M. Bale.

PROTOZOA.

On the Freshwater Infusoria of the Wellington District. W. M. Maskell, Trans. N.Z. Inst. XX.

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Royal Society, N.S.W.—Vol. XXII.: Phytographic expressions and arrangements. F. v. Mueller; Indigenous Australian Forage Plants, other than Grasses, including plants injurious to stock; Some N.S.W. Tan Substances, Part V. J. H. Maiden.

Royal Society, South Australia.—Vol. XI.: Additions to Flora of Port Lincoln district; Plants of Lake Eyre Basin. R. Tate; Fungi collected near Lake Bonney. M. C. Cooke. Vol. XII.: Revision of the Flora of Kangaroo Island; Census of the Indigenous Flowering Plants of Extra-tropical South Australia; Four new species Australian Plants described. R. Tate; Geographical distribution of Australian Characeæ. F. v. Mueller; Notes on Australian Fungi. J. G. O. Tepper; Gums, and a Resin produced by Australian Proteaceæ. J. H. Maiden.

Royal Society, Queensland.—Vol. V.: Queensland form of *Nipa fruticans*; On *Acacia melaleucoides*. F. M. Bailey; Bryological Notes. C. J. Wild. Vol. VI.: The Lichen Flora of Queensland, Part II.; Addition to the same; The same,

Part III. J. Shirley; Notes on Lichens in N.S.W. F. R. M. Wilson.

Institute, New Zealand.—Vol. XX.: Notes on the Three Kings Islands; On the Flora of the Kermadec Islands. T. F. Cheeseman; Naturalised Dodders and Broom-rapes of New Zealand. T. W. Kirk; New species New Zealand Phænogams, Ferns, Cryptogams, described. W. Colenso, D. Petrie, J. Buchanan. Vol. XXI.: On the Desmidieæ of New Zealand. W. M. Maskell; Botany of Te Moehau Mountain, Cape Colville. James Adams; *Orobanche hydrocotylei*, supposed new species; New species of Cryptogamic Plants; Of Phænogams. W. Colenso; On the movements of the pistil in *Glossostigma elatinoides*. Clement W. Lee.

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Australasian Association for the Advancement of Science, Section D.—On the action of Metallic Salts in the development of *Aspergillus nigrescens*. W. M. Hamlet; On respiration in the roots of Shore Plants. J. Bancroft.

The Forest Flora of New Zealand. By T. Kirk, F.G.S., &c., is spoken of as a magnificent work on the trees and shrubs of that isolated region.

Geology and Physiography.

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New Zealand Institute.—Vol. XX.: On Sections in the Weka Pass; The Greensands of the Waihao Forks; On Fossils from the Cobden Limestone, Greymouth; Ancient Rhyolites from Mataura described; On a Leucophyre from the Selwyn Gorge. F. W. Hutton; On the Oxford Chalk Deposit, Canterbury, N.Z. H. Wilson; On the Tarawera Eruption. J. Hardcastle; The Artesian Well System of Hawke's Bay; Geographical Distribution of Pumice in N.Z. H. Hill; On the Volcanic Rocks of the Taupo District; On the Rocks of the Kermadec Islands. A. P. W. Thomas; On the King Country. Laurence Cussen; Geological Notes on the Kermadec Group. S. Percy Smith. Vol. XXI.; The Fall of the Leaf (from the Geological standpoint). J. Rutland; The Amuri Earthquake. F. W. Hutton; Diatomaceous Earth near Oamaru. Harry A. de Lautour; On a Deposit of Moa Bones. A. Hamilton; On Fossil Moa Feathers; On the Oil Prospects at Poverty Bay. H. Hill; On N.Z. Coal. James Park; The Alluvial Deposits of Otago. L. O. Beal; Geology of Tongariro. A. P. W. Thomas; On the Islands S. of N.Z. A. Reischek; On the Waikato R. Basins. L. Cussen.

Victorian Naturalist.—Vol. V.: Geology of Arnhem's Land, Pts. I. II. J. E. T. Woods.

Australasian Association for the Advancement of Science, Section C.—On some salient points in the Geology of Queensland, Address by the President of the section, R. L. Jack; On the Metamorphic Rocks of the Omeo district, Victoria. A. Howitt; Age of the Mesozoic Rocks of the Lake Eyre Basin; Glacial Phenomena in S. Australia. R. Tate; Origin of the Laterite in the New England district; Cupriferous Tufts of the Passage Beds between the Permo-carboniferous and the Triassic beds in N.S.W. T. W. Edgeworth David; The Mesozoic Plains of S. Australia. H. Y. Lyell Brown; The Rocks of the Hauraki Goldfields. F. W. Hutton; Geological Sequence of the Bowning Beds. J. Mitchell; On boulders met with in the beds and reefs of the Gympie Goldfield. W. H. Rands; On the discovery of Fossils at Rockhampton. J. Smith; How can Australian Geologists safely rely upon the order of the Succession, &c. R. M. Johnston. *Ibid.*, Section D.—On the Influence of Physiographic changes in the Distribution of Life in Australia, Address by the President of the Section, R. Tate.

The Department of Mines, Sydney, has published the two first parts of Vol. I. of Records of the Geological Survey of N.S.W., containing—(1) Notes on the Geology of the Barrier Range, Mt. Browne, &c., by C. S. Wilkinson; (2) two papers on Aboriginal remains, by T. W. Edgeworth David and R. Etheridge; (3) On a Lonsdaleia-like Coral; on *Dromornis;* on *Cycadopteris scolopendrina* Ratte, by R. Etheridge; (4) on a species of Lepidodendron from Goonoo Goonoo, by R. Kidston; (5) on the Ossiferous clays of Myall-Creek; on the Fish and Plant beds of the Talbragar River, by W. Anderson, with other Petrological and Mineralogical papers. There appears a sharp discussion on the genera *Nototherium* and *Zygomaturus* in reply to Mr. Lydekker by C. W. De Vis, with note by the former, in Ann. and Mag. N.H. (6) IV., p. 257. I find also a paper on *Atherstonia*, n.g. Palæoniscida, from the Karoo formation; and on a tooth of *Ceratodus*

from the Stormberg beds, by A. S. Woodward (Ann. and Mag. N.H. (6) IV. p. 239).

In conclusion, Gentlemen, you will all remember the occasion when the hall in which we are now assembled was opened and presented to the Society with the unostentatious munificence characteristic of Sir WILLIAM MACLEAY. You will also remember with what hearty and unanimous assent it was resolved to record our grateful appreciation of his action by a permanent token, in the form of a portrait executed in marble and erected here in a conspicuous place of honour.

This resolution was arrived at on October 31, 1885; but owing to unavoidable delay it was long before the committee appointed to carry it into effect, Dr. Cox and Mr. MACMAHON, were able to complete their arrangements. At last however, on June 22, 1889, the excellent bust of Sir WILLIAM MACLEAY, which you see before you, the design and handwork of Signor SIMONETTI, of Sydney, was formally unveiled. On that occasion I had the honour of giving some expression, though in inadequate terms, to the feelings with which this Society rightly regards their eminent benefactor, and of reminding you, by a brief summary of facts, of some of his principal services; and I think you will consider it not an improper use of the present opportunity if I now proceed to repeat, from a report in the *Sydney Morning Herald*, a small portion of what I had then to say upon the last head:—

"I can only enumerate a portion of the many and great benefactions by which Sir WILLIAM MACLEAY has fully earned and fully gained the sincere and deep gratitude which we have met to testify by an enduring token. But I must remind you at least of his having borne all the expenses of our unfortunately brief establishment in the Garden Palace, of his gift of one admirable library of Natural History, which was to be consumed in the subsequent conflagration, only to be replaced by the still more costly, extensive, and, I may almost say, invaluable collec-

tion which you see upon the shelves around you, and which he is still from day to day expanding and enlarging in all directions. I must also remind you that he has from the time of that fire never ceased to entertain the Society in a home found for it by his own hospitality—first in an office, then in a commodious dwelling-house, and finally in this spacious hall, presented to the Society on the occasion to which I have already referred.

"Sir WILLIAM MACLEAY has borne the greater part of the expenses of the Society's publications, has supplied the salaries of its officers, furnished its specialists with abundant funds for their investigations and their maintenance, and has equipped this establishment with its fittings, furniture and apparatus for research. He has moreover obtained for us the Charter under which the Society reckons upon permanence, perhaps for centuries to come. In the gift to the University of his magnificent collection for natural history, special provision is made that the Macleay Museum shall be available for all purposes of study and research to members of this Society on equal terms with the members of the University. Moreover in the noble foundation which he is establishing for the support or assistance of real investigation and original workers in Science, he has once more shown how completely he has identified himself with this Society by throwing upon the Council the whole and sole responsibility of selecting among duly qualified candidates for his Linnean Fellowships, those who shall show and give promise of the greatest aptitude and industry for their several and special line of research. He has arranged to bequeath—may it be long before the bequest fall due!—the sum of £35,000 for the establishment of four "Linnean Fellowships" of the annual value of £400 each, tenable for one year only at a time, but open to renewal year after year upon satisfactory proof being given to the Council that the holder has laboured during the preceding term with earnestness, perseverance, and success.

"Whether the distinction which has been recently conferred by the Crown on our member is in any way due to the work which he has carried on in this Society, I can only conjecture; and there

are so many grounds upon which the Crown might have been well advised to grace him with this honour, that I feel some hesitation in forming that conjecture. But in any case we congratulate ourselves also when we congratulate a fellow member upon his well earned dignities."

Now gentlemen,—I have no doubt that our friend Sir WILLIAM MACLEAY would have preferred that these remarks should not have been repeated here to-day, even though their expression might have been on the first occasion unavoidable. But I regard it as no unimportant part of my duty as President, to take care that not only all the members of our own Society, but also those of kindred associations in Australia and elsewhere should be made acquainted in some degree with the kind of assistance and the extent of support which Natural Science has in this country received from his unstinted liberality. In such a case, silence would betoken ingratitude. And in the second place I cannot but consider that the whole Australian people is very much interested in such examples as this of the life of Sir WILLIAM MACLEAY, displaying as it does both the energy and perseverance requisite for the honourable acquisition of wealth, and the rarer qualities of understanding how that wealth may best be applied to advance the public intelligence and welfare, and of perfect generosity in devoting it to that service.

FLOREAT SOCIETAS LINNEANA!

On the motion of Mr. Trebeck, a vote of thanks was accorded to the President for his interesting address. Mr. Trebeck also gave expression to the feelings of honour and esteem in which Sir W. Macleay is held by the members of the Society.

The following gentlemen were elected

OFFICE-BEARERS AND COUNCIL FOR 1890.

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James C. Cox, M.D., F.L.S.
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Honorary Secretaries:

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